AGRICULTURAL PROGRESS.

AN OUTLINE OF THE

COURSE OF IMPROVEMENT IN

AGRICULTURE

CONSIDERED AS A BUSINESS, AN ART, AND A SCIENCE, WITH SPECIAL REFERENCE TO

NEW BRUNSWICK.

"—*E pur se muove!*"—GALILEO.

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The progress of Agriculture is the index of the progress of civilization; for the development of any art can only be the result of the gradual and progressive development of the intellectual faculties of man.

Now the faculties of man are given to him by nature; but they are awakened by his necessities, and they are educated and influenced by his external conditions and circumstances. The influence exerted by other men, together with that of climate and of soil, are the most important of these controlling powers. One man copies another, one man educates another and leaves him to progress one little step in advance; each generation uses the wisdom of the past, adds a little to it, and transmits its acquisitions to the next; so that the race grows in knowledge from age to age, just as the mind of a man expands with his body; and the fulness and ripeness of wisdom is attained only after the accumulated experience of years. But, as I have already said, this education of the human race is controlled and modified by climate and soil: In cold countries man has to struggle incessantly with nature for the bare means of subsistence, and he deems his duty done when he has secured wherewithal to feed and clothe and shelter his body: the mind receives no proper share of culture, for every moment is consumed in the anxious struggle for life: Nature is almost to be regarded as the conqueror. In hot countries, again, the struggle between man and nature takes another aspect; man is overpowered by abundance; little exertion is required to sustain life, and his mind is enfeebled by indulgence and the want of wholesome occupation. In temperate regions, and in the cooler portions of these, perhaps, the mind and the body of man can alone attain to their proper development. Here man may be said to conquer nature and make her his slave.

In the original condition of things, man subsists by the chase of wild animals or by fishing. It is the age of Hunters and Fishermen. The Esquimaux are still in that primitive state, depending for their very existence upon conditions which they cannot control—and the Aborigines of this country were so when they were first seen by Europeans: for Agriculture was unknown or only dimly dawning in the wilds of Acadie.

The next age is the Pastoral one. Some of the wild animals have been domesticated, and man subsists by the produce of his

flocks and herds. On the borders of perpetual snow the Laplander is sustained by his herds of reindeer; on his southern, sultry plains the Arab depends upon his herds of camels; while in temperate regions the Cossack or Tartar tribes subsist by their horses, sheep, and oxen.

As mankind multiply, parts of the land required for hunting or pastoral purposes, are occupied and appropriated by individuals, so that only under peculiar conditions can the primitive state be continued. The wandering shepherd or hunter has discovered that he can domesticate food-plants as well as animals, and that he can by cultivation on certain soils get a better and more abundant return from the seeds which he has sown than from the same seeds in their wild or natural condition. This is the dawn of the Agricultural state. The wandering tribes which hitherto lived upon shell-fish and fruits, or followed the chase, or the tracks of their flocks as they periodically pursued the upspringing herbage, can now make a pause and sit down. A convenient locality near a river is selected, and houses or hamlets begin to crowd each other upon the fertile and well watered plains. Each man now settles down to the work which he thinks to be best suited to his capacity, and the principle of the subdivision of labour is recognized. Some become manufacturers, who apply their labour to add utility and value to the raw materials yielded by nature; some devote themselves to the business of farming, to supply the food and clothing required by the community; while others conduct the exchanges between the producers of the raw material and the manufacturers. Society has now become organized, and the community is set off into groups of agriculturists, manufacturers, and merchants, with their incidental attendants.

Although this exact sequence does not take place universally, yet such may be regarded as the natural progression; and, that there is good reason for this passage from the hunting condition to that of the agriculturist, we may learn from the recorded speech of an Indian Chief, addressed to his tribe with a view of persuading them to abandon their primitive and precarious mode of subsistence. I have ventured to give a rythmical form to this remarkable address:—

> See ye not that the Pale-faces feed upon grains,
> While our hunters must live upon flesh;
> That the flesh will take thirty long months
> To grow up and be fit for our use,
> And that it is frequently scarce?
> That each of those wonderful grains,
> Which they strew in the bountiful earth,
> Yields straightway a thousand for one?
> That the grains will remain and grow up
> On the spot where the pale-faces leave them?
> That the flesh which we live on each day

Has four legs to flee from our grasp,
While we have but two to run after?
That Winter, which is unto us
The season of toil and of hunting,
Is to our new neighbours the time
In which they enjoy their repose?—
No wonder, I trow then, that they
Have so many children—and live
So very much longer than we do!
I therefore declare unto all
Who sit in the Council around,
That ere these dark cedars decay,
And these maples refuse us their sap,
The race of the eaters of corn
Will replace all the eaters of flesh,
Unless ye—O men of my tribe!
Wild warriors and hunters—resolve
To exchange the pursuits of the chase
For the work of the wise husbandman.

As population increases Agriculture keeps pace with it; the forests are burnt down; marshes are drained and become verdant meadows; river courses are narrowed and restrained, while even the sea itself is staid and limited by dykes and dams. Neptune is dethroned by Ceres, and, instead of marine weeds, sea bottoms at length bear waving crops of yellow grain.

The great influences which affect the onward progress of Agriculture are intimately connected with the three elementary conditions of society; they especially bear upon what may be called the business of farming. Let us therefore begin by glancing at the principal conditions which influence Agriculture considered as a business, namely, first, the *Land* or raw material considered as property; second, the *Labour* to be applied upon the land; and thirdly, the *Market* or demand for the surplus supply which labour derives from the land.

On reviewing the various changes which have taken place in regard to the simplification of the tenure of land, the amount and the quality of the labour at the disposal of the farmer, and the free development of commerce, and facilities of transport to the markets of the world; in reviewing all these particulars, I say, it will be seen that there has been a great, if not always a progressive improvement, which is very gratifying as regards the past, and not less encouraging as regards the future.

Having glanced at the three points above named—the three prime conditions of agricultural progress—I shall then refer to the actual progress of the Art itself, and to that of the philosophy or Science of modern Agriculture.

In the outline which I thus propose to offer, it will be my aim to direct attention rather to principles than to what are called the practical details of the subject, for, that which I most desire to inculcate is an intelligent apprehension of those principles which

dominate and direct the routine of daily practice, and stimulate our public and private efforts at improvement.

1. *Of the tenure of Land.*

The word *tenure* means the holding of land under another, but we here use it to signify *title* generally, or the right which the farmer has to the land of his farm. By English or Colonial law all land is deemed to belong to the Sovereign, and the "landlords" are his tenants: By the law of the United States, again, wild land belongs to the State, and when granted is absolutely transferred to the grantee. His tenure is *allodial* and absolute: while in the former case it is an Estate held in fee from the Crown—but a *free hold.* This relation between the cultivator and the land upon which he is to confer utility, that is *fertility*—this "tenure," or power of carrying on the business undisturbed, has had an important influence upon agricultural progress; and a glance at the variations which have existed in this particular will not prove uninteresting.

Among the early German nations, land belonged to the community in general, but when they occupied the Roman Provinces, the conquered territory was parcelled out among the chiefs of tribes, who again conferred them in part upon their followers, for life or for a term of years—but not absolutely; this is the origin of the feudal tenure. The Saxons who invaded and occupied the territory of England under Hengist and Horsa, A.D. 451, were warriors rather than husbandmen, and when the land was divided among their chiefs, the latter cultivated one portion near their *villa* or mansion called the *infield,* by their slaves or villeins who were chiefly the conquered Britons, while the *outlands* were let to their retainers or soldiery who paid a rent in kind for the use of the land. This is the best kind of rent (*reddendum*), and, by law, it was fixed for a farm of ten hides or ploughlands, as follows:—10 casks of honey; 300 loaves of bread; 12 casks strong ale; 30 casks of small ale; 2 oxen; 10 wethers; 30 geese; 20 hens; 10 cheeses; 1 cask of butter; 5 salmon; 20 loads of forage; 100 eels.* Money rents were almost unknown, and the art of farming was very imperfect, though the land was good. After the Norman conquest in 1066 the landlords were changed, but the right which the farmer had to the land was not improved. The great lords themselves could hardly be said to *own* the land, for, under feudal institutions, the Sovereign was regarded as the only *landowner* or proprietor in the Kingdom. A barony or fief was granted by him to a knight for military service or for valor in the field, and the grant was conditional to further suit and knightly service at the will of the Sovereign. This suit or service was the *rent,* and the barons remained the vassals or tenants of the King's Estate. Absolute ownership of

* Encyc. Met. "Agriculture."

the soil, or allodial tenure, was not unknown on the Continent of Europe in these early times, but in England it hardly existed after the time of the Saxons. Between the barons and the actual cultivators of the land, their retainers, as they were called, who were likewise protected by their master against other chiefs, there was no proper contract; although in some cases a rent partly in kind and partly in military service was required. The society was like that of a regiment, good for defence but incompatible with civil freedom. War and hunting were the principal pursuits of the great lords, and much of the arable land of England was blocked up for the chase and for pasture, while the actual farmers were constantly called away from their business and commanded to turn their pruning hooks into spears or their spears into pruning hooks, as their master or their master's master dictated. The military principle was alone intelligible. This state of things almost justified the strong terms used by an early historian as to the feudal nobility of England:—He calls them "depopulators, destroyers of villages, robbers, tyrants, basilisks, enemies to God and man, and—who would all go to the devil when they died."

When Henry VII. had united the rival claims of the great houses of York and Lancaster in his own person, the civil wars of England subsided, population increased, and the arts of social life began to flourish. Cities were established, the great lords became courtiers rather than soldiers, and they began to take more pride in their lackeys than in armed retainers: accordingly they gradually converted the old tenure of military service into a money rent or payment which went to maintain the new fashioned magnificence of the knights or nobles. Such tenures were said to be *by socage*. Military tenures were abolished by law about the time of their respective "Revolutions" both in England, France and America. Nevertheless the laws passed in England during later Reigns were generally made by the landlords, who conceived the feudal system to be almost a divine institution, and greatly mystified the subject of land property, land leasing and land selling: so that even at the present day these laws have been called the disgrace of the English Statute Book. They assume that the landlord still protects his tenants from oppression or violence, or exercises a military jurisdiction over them as the barons did of old. The growth of towns and of manufactures effectually undermined these hereditary powers and jurisdictions of the feudal nobility, but the English people have yet to reform the laws affecting that which is technically and typically termed Real Estate.

Without a simple title, and absolute security as to the free disposal of land by sale, gift or devise, the cause of agriculture must always be more or less endangered, and I for one, cannot see why the trade in land—there, as here—should not be as unfettered as

the trade in corn or calico. Under the feudal system, land was a thing out of commerce altogether.

Landed property in England when held under the Crown, is said to be *freehold*. The tenure by *copy hold* is from a subject, and may continue liable to the original proprietor for money payments or fines, on account of deaths, transfers, and other contingencies. *Leasehold* estate is that which is held from the proprietor for a term of years, say from one to one thousand years, or for a life, with a fine on renewal, and with or without a power of alienating the title.

The usual length of a farmer's lease in England is seven, fourteen, or twenty one years; although in the southern Counties more particularly, they are often for one year only. The sacred number *seven* predominates, probably, because by the Jewish law, the land rested in bare fallow every seventh year.* Nowadays, however, when land is seldom rested or bare-fallowed at all, and when the best rotation is one of four years' alternate cropping, the retention of seven and its multiples, for the terms of leaseholds, seems to be simply ridiculous.

In Ireland there are many large estates, but the actual tillers of the soil, or at least four-fifths of them, are cottier tenants. That is, their rents are paid in labour, which is the same as saying that the labourers' wages are paid in land, while the rate or amount of this rent is determined neither by law nor custom, but by *competition*.†

In this way the whole kingdom has been cut up into small holdings, and sub-letting is practiced to an almost incredible extent. The landlord leases to a middleman, the middleman to a sub-middleman, who lets to a tenant, who sub-lets to a sub-tenant, who transfers part to a cottier, who again shares it with a squatter or actual labourer—the last and lowest term of this melancholy series. How different from Switzerland, where although three-fourths of all the farms do not exceed one acre, still that one acre is owned by the actual farmer, and instead of misery and turmoil, peace and plenty is the rule.

In 1841, three hundred thousand farms, or more than one half of all the farms in Ireland were under fifteen acres. On Lord Palmerston's Irish estate, from which shiploads of fever patients were sent over to New Brunswick in 1847, there were in the previous year, one hundred and thirty five tenants on two hundred and one acres—of bog.

The income of these Irish labourers was not a money income, but the produce of the bit of ground allotted to them. Hence then the land must be bid in, whether the rent was to be paid or not.

* Morton's Cyclop. "Lease."

† M'Culloch's account of British Empire. Porter's progress of the Nation.

Those who did not get a patch of land, must either starve or emigrate. Hence the overwhelming distress which, with the aid of a bad season, the potato blight, and the cholera, led to the Irish Exodus, as it has been called, and to the probable regeneration of Ireland. It was necessary, in fact, that Providence should interfere to repair the fabric of Society, which had been destroyed by a long course of selfishness and error on the part of the landlords. The cottier tenants of Ireland were in one sense more abject than the slaves of the South. The slave owner is compelled by law to subsist his labourers even in disease and old age, but the Irish landlord, who gave his tenantry only "potatoes and point" when they were in health, left them in old age to beggary and starvation. I travelled from Cork to Dublin in July 1840, and the aspect of the country was then such as gave me the idea of a land eaten by locusts or ravaged by war; while that of the people was such as could only have resulted from whole centuries of misery and degradation. Slave countries are sad enough spectacles, as I can testify, but there at least there seems no want of good living and jollity; while in Ireland, body and mind seemed to be irretrievably ruined by the long continued want of food, clothing, and shelter—the first necessaries of life.

Since the Famine and Exodus, most of the Encumbered Estates have been sold by authority of special law; and English capital, and Scottish skill, and better tenures, are at the present time co-operating to bring back to Ireland that fertility which properly belongs to it, and which enabled it under one of the worst systems of agriculture, and when the landlords would spend nothing on the land, and consequently were the greatest burthen on it, to feed eight millions of people, and allows it, at the present moment, to export to Great Britain, produce to the amount of four or five millions of pounds sterling every year.

In Scotland, leases are generally given for nineteen years, or for one, two, or three rotations of the usual crops, with covenants that no two white crops shall follow in succession, that the green crops shall be fed upon the place, and that if hay or straw is sold, an equivalent quantity of manure shall be brought back to the land. These covenants are good, at least they were so for the time when they were instituted. They might all now be embodied in one comprehensive expression, viz. that the tenant shall return to the land in manure, at least an equivalent for the previous crop. With such a proviso in the lease, and with proper security for its fulfilment, he may be fairly trusted to follow his business as he may; for that only means that he shall give back the land in at least as good condition as he borrowed it from the landlord.

The system of landlord and tenant would work well enough under such a law; for while the land is the landlord's capital, and he

draws his income from it as rent, it is his interest to undertake permanent improvements upon it so as to render it a better and more desirable article for use; the farmer on the other hand, can apply all his capital and skill to raise the best crops from the land and increase its fertility. The regularly recurring demand for rent also obliges the latter to exert his best faculties, which too often in this country are left to rust under the perennial slothfulness sometimes engendered by an undisturbed freehold tenure.

In old times, the Scottish tenant was very much at the mercy of his landlord. He was generally a tenant at will, and in cases of dispute, which were not uncommon, he could only appeal to his landlord as judge, or to one of the same class, whose will was received as law. This seems almost incredible. But so it was; and in 1748, that is, at the reorganization of Scottish society after the battle of Culloden, an Act was passed abolishing these hereditary jurisdictions, the legacy of old feudal times, and transferring appeals such as the above to the Sheriff's court, where all the King's business in the Counties was to be brought. Agricultural improvement was impossible until that Act was passed, when the lessor of land was put upon the same footing as the lessor of houses, the lender of money, or the vendor of horses and hardware.

On considering the comparative advantages of freehold and leasehold farms, I am however obliged to come to the conclusion that ownership in freehold, or some tenure as like to it as possible, is the best. At all events there can be no hesitation about it in this country, where the price of new land is low, and its utility as a farm depends mainly upon the labour expended upon it. But if any stranger desires to try a New Brunswick farm on a short lease, you will forgive me if I advise him—privately, of course—to do as some freeholders do themselves. That is

First—To take as many corn crops in succession as possible, because that will secure immediate returns.

Second—Not to raise green crops, because the worm or fly might devour them, and it takes some time for the improved stock to pay for the outlay.

Third—To lay such manure as can be got, on the land which is in *best* condition for it, because that will save all trouble about the worn out fields.

Fourth—To hire out his own labour and that of his horses or oxen, as often as they are required by others, because that will bring in some ready money at all events.

Fifth—To neglect roads, fences and buildings, and all permanent improvements, because an outgoing tenant need not concern himself about an incoming one, or the landlord either; and as for the drains—*apres moi, le deluge!*

A tenant who would do such things might be called by hard names; but what name shall we find for the freeholder who indulges in them? The tenant might be called a knave.

According to the modern doctrines of political economy, land belongs primarily to the State, and the State is bound to render its acquisition as easy and complete as possible to such of its citizens as seek to use it. Where it has been so granted by the State, let property in land be held as sacred as in any thing else; but let landlords know that its possession is a trust from the State for the common good.* With these views of the responsibility of landowners, landownership will probably always be the most conducive to agricultural progress.

In order to illustrate the progress of improvement as regards the tenure of land in the British Colonies of North America, I shall make a historical review of the changes that have actually taken place in this respect within the limits of New Brunswick itself.

New Brunswick, Nova Scotia, and Prince Edward Island, were known at one time under the common title of Acadia; and Acadia was part of the Colonial Empire of France.

Nova Scotia proper was conquered by the English in 1710; but the French kept up a sort of a claim on New Brunswick until the Peace of Paris, which was concluded after the conquest of Canada.

The first grants of land on the River St. John were made to military officers and gentlemen, servants of the French Crown. They were of the nature of fiefs or feudal seignories, and they often contained from 10 to 100 square leagues. I have seen about 20 or 30 of these Seigneurial Grants, and they covered some of the best lands in the country. Under these tenures the Grantees exercised some sovereign powers within the limits of their Grant; for instance, they could hold Courts of Justice and fix the Officers and Rules thereof. At these Courts, for such crimes as angry words, contradiction or scandal of the Seignior, the poor vassals were sometimes obliged to appear in court, bareheaded, kneeling, fettered, asking pardon of their offended lords, and they were punished very much according to the mercy or discretion of the Judge. The Seigniors had the right to forfeited lands and to such as had no apparent heirs; to waifs, strays, and treasure trove; also they had the monopoly of fishing and hunting, and of trading with the Indians.

On the other hand, military service was invariably required of Seigniors, and they had to pay fealty and homage to the King or his Officer at Penobscot or Quebec, and to pay one-fifth of the price *(quint)*, or one year's gross revenue *(vexin le Francais)*, on every change of proprietorship of the fief.

The Grantee was also bound to make periodical returns of his

* Mills' Political Economy.

leases and revenues from the land in any way; also, there was a reservation of all oak timber for the King; of land for roads and military works, together with timber required for the latter and fuel for the barracks.*

The Seigniors were of course bound to insert similar restrictive charges in all leases to tenants, who, besides a quit-rent in money and a rent in kind, (*redevance*), had to pay a fine of 1-12th on all transfers of lease, (*lods et ventes*), to bring their bread to the seigniorial oven, and all their grain to their lords' mill, (*banalite de moulin*), the toll being fixed at 1-14th of the corn ground. There were other obnoxious restrictions which I need not mention.

These feudal tenures, so vicious in themselves, so inconsistent with freedom and progress, continued to prevail in Lower Canada until last year, when an Act passed for their commutation, after great trouble and difficulty.

After the Peace of Aix la Chapelle, in 1748, when Nova Scotia became the acknowledged domain of the English Crown, its settlement was vigorously undertaken by the Home Government; and as there were great numbers of disbanded soldiers and sailors on hand after the peace, Lord Halifax in 1749 sent out three or four thousand families; to each member of which lands were granted in fee simple, almost unconditionally, and with rations for two years.

Between that time and the Peace of Paris in 1761, the disposal of vacant lands in Nova Scotia and New Brunswick was in a great measure left at the discretion of the Governor, although few regular surveys as yet were made. After the acquisition of the whole of New France, many free grants of land were made to the old officers and soldiers, and there arose a great mania for land speculation in the Colonies. This was encouraged by the Home Government, and before 1773 much of the Crown land of Nova Scotia was granted away in the Counties of Cumberland (Morse, &c.) and Sunbury, by which names the Province of New Brunswick was then known. The grants to Simonds, Hazen, White, and Peabody, and the old settlers of Sunbury County, to General Gage, Colonel Mauger, Colonel Spry, and Major Dight, are well known. Grants at this time were chiefly made under licences or location tickets issued by the Governor in Council to a leader and associates; that is to say, a certain number of associates (apparently to save office fees,) applied for a large tract of land including not more than 1,200 acres to each of the applicants, as the Grants were limited to that quantity under the royal instructions. After the patent had passed to the leader, the associates frequently transferred to him for a trifle—a gun or a dog, as is said—the most of their lot; as in fact, the whole scheme was privately got up thus to elude the royal instructions in the case.

* Canadian Seign. Doc.

Large grants of land were also made from time to time to persons in the old country or to such as had interest with the Government of the day. In the year 1767 Prince Edward Island was thus granted away in one day in 67 lots of about 20,000 acres each, subject to conditions of settlement within ten years and the payment of a small quit-rent. As it happened, neither the rents were paid nor were the settlements effected by the proprietors, and much difficulty arose between the tenants and the absentee landlords, many of whom would not give leases for more than 40 years term. After much and serious disturbance, the disputes between the tenantry and landlords of Prince Edward Island were all quieted by law within the last few years. These large grantees were something like the French Seigniors, although they never exercised powers of jurisdiction.

In 1773 the English Government had many of the large Grants in the lower Colonies escheated, and in the following year the best lands for settlement were ordered to be surveyed and divided into lots of from 100 to 1000 acres each, and sold by public auction at an upset price of 6d. per acre. The lands so purchased were granted in fee simple on payment of a quit-rent to the Crown of 1s. 2d. sterling per acre. The American Revolution broke out soon after and the above scheme produced no results.* In 1775 Lord Dartmouth directed the above order to be suspended and gratuitous grants to be made to refugee loyalists from the revolted Colonies. In 1784 New Brunswick was by Royal proclamation set off from Nova Scotia, and in this same year Governor Parr passed Grants, to the number of nearly five thousand, to the loyalist families who came into the country for an asylum. These grants were all chargeable with a quit-rent, payable on St. Michael's day yearly for ever, after ten years from date of Grant; they were also burdened with a reservation of all pine trees fit for masting for the royal navy; of all gold, silver, copper, lead, and coals; with conditions of clearing, draining, or building within a given time; and with an obligation for each new proprietor to take the oath of allegiance.

In 1808 Canadian pine was thought better for masting, and that reservation was removed from New Brunswick; also the grants of land were limited to 100 acres to the head of a family and fifty acres to each child, but not to exceed 500 acres in the whole. The conditions now were, that the Grantee should settle down and improve the land; that he should plant hemp and flax where the soil was suitable, and likewise pay the office fees, and a quit-rent of 2s. for every 100 acres on midsummer's day yearly for ever after. A few large grants were however still made to members of the Executive Council and others "by special favour of His Majesty," as it was said.

* Evidence under Major Head's Inquiry.

In 1827 Lord Bathurst sent out new instructions for the granting of land within the North American Colonies, and a greater degree of uniformity was attempted on this point, although a few grants continued to be made on the old tenure until 1837. Under this new system the Crown Lands Office was for the first time brought into operation as regarded the disposal of lands. By these regulations of 1827, Crown Lands not exceeding 200 acres, could only be obtained on the condition of absolute purchase, or with quit-rents payable for seven years. The upset price of land offered for competition was to be 2s. 6d. per acre, including grant fees and fees of survey, and the money payable in four annual instalments if desired. Old settlers, moreover, with incomplete titles, were allowed to retain their lands, provided that all fees and quit-rents were paid up before January 1828.

The proposed forfeiture of lands for non-payment of arrears gave great dissatisfaction, and land sales had to be discontinued for a time. Some escheats were also made for non-payment of quit-rents, although the Grantées were never disturbed in possession; and by Act of the Legislature a sum of money was granted from the public revenue to the Crown in lieu of all past claims. The quit-rent system was found to be impracticable and it was finally extinguished.

The system of land sales gradually improved and many settlements were effected. But the easy terms of payment favoured speculation; and as large blocks could also be got for lumbering purposes on terms that could easily be evaded there was great excitement on the subject for a time. Many large blocks of wild land, for instance, were bought in 1835 at a price not less than 10s. per acre, to be afterwards in great part restored to the Crown for default of payment. At the final surrender of the casual revenue in 1837 the management and control of Crown Lands, woods, mines, and royalties, was transferred to the Legislature, and the present system was introduced of selling at auction all lands (except to actual settlers) in blocks not exceeding 100 acres, and the money paid down within fourteen days. In certain cases, moreover, the law now permits the price of land to be paid in labour upon the public roads. Thus, the tenure is of the best—I mean one in fee simple or in free and common socage—and the mode of getting the desired lot and the terms of payment ought to be satisfactory to all.

The price thus paid for freehold grants of land in these Colonies, is given with the understanding that from the fund so accruing, the officers of State government are to be remunerated. In New Brunswick, the *best third* of the public lands, or to speak more technically, of the Crown domain, has been already alienated: and the last remnant of the old, complex, and clumsy conditions, which one by one have withered and fallen into "the tomb of the Capulets,"

is the reserved royalty on "gold, silver, coal, and all other mines and minerals." The tendency is, and I am glad to think so, to abolish even this interesting relic of the Gothic ages, and to make the grantee truly the lord, not only of the soil, but of that which grows or feeds on it, and of all that which exists beneath it. In this free country there attach to the grant of land no homage or fealty, no military service, no priestly tithe, no quit-rent, covenant, or condition, no fines on sale or inheritance; and the transfer of land is as simple as that of ordinary merchandise, save only that to be valid in law, all grants or deeds are to be officially recorded.

It has been said, and truly said, that the power of a State is in proportion to its population; its population is in proportion to its fertility; its fertility is in proportion to the energy of its farmers; the energy of agriculturists is proportionate to their direct and personal interest in the soil. Hence the more nearly the farmer resembles a mercenary, the less industry and activity does he possess; on the other hand, the nearer he approaches the condition of a freeholder, the more he developes the strength and productiveness of the soil, and the general wealth of the State. In Europe and elsewhere, "the omnipotent principle of property in land has converted the most barren sands into gold," and its proper influence everywhere is to give strength, energy, dignity, and independence to the character of men. Self-respect necessarily involves a desire for civil and political liberty,—"that political liberty which moves men, inspires great thoughts, diffuses light, and enlarges the limits of human knowledge."*

These first principles of action therefore, are the natural results of the feeling of undisturbed ownership in the soil; and where they do not follow from it, there are some counteracting influences at work, which it is the duty of the State to obviate and overcome.

The low price of land in the American market as yet begets influences and conditions which are only discernible after some time. In fact this condition colours the whole subject of American agriculture, and materially modifies the speculations of Europeans thereupon; for whereas in Europe increased productiveness is chiefly attained by an increased outlay of skill and capital, increased productiveness is speedily attained here by means of a *fresh burn*. That is to say, it is easier apparently to bring new land into cultivation, than to restore the fertility of that which has been exhausted by excessive cropping. No great art is involved in *falling* and burning the trees of the forest; while the charcoal and mineral matters of the burnt trees, and the absorbent influence of the roasted soil, combine to yield a crop which more than pays for the operation. Thus a virgin soil can be cheaply procured at any time, and when it has been once exhausted by cropping, the field

* Von Tschudi, "Peru."

may be laid down to pasture until fertility is restored, while another piece of the forest is brought in to undergo the same treatment. This may not be the best method, but at all events it is a natural one for poor men to follow, inasmuch as it involves least outlay of skill, labour or capital; but it is a small business, and in fact is hardly farming at all. New Brunswick farmers at present generally belong to a class who are easily satisfied; almost all may raise enough for their daily wants; they have no rents or tithes to pay; they need not amass riches for their children, who can work the old farm, or take another as suits their inclinations; the *log-crop* is not yet exhausted, and it promises an immediate return: these influences, be they good or bad, certainly tend for the present to retard agricultural improvement.

It is the first business of philosophy to account for things as they are, before attempting to prescribe a remedy: our present object therefore is to clear the way for the introduction of something better. Time is money, it has been said,—but wisdom is better than gold, and knowledge is both light and power; and an indoctrination of the rural community with a knowledge of the principles, practices, and results of modern husbandry, ought to bring about the desired result here as elsewhere; that is, as soon as labour can apply this knowledge, and freely bring its products to market.

Homespun for the back, and roast mutton for the belly: these are good things enough, but they ought not to be the highest prizes and rewards of the cultivators of the soil. *Man does not live by bread alone.*

2. *Of Labour—Its kind and amount as affecting Agricultural progress.*

Land, like other raw materials, acquires value by labour, and the kind of labour and the supply of it which is at the command of the husbandman, has always materially influenced the course of his business.

At first, man uses his own strength, which is made more efficient by its being applied through the medium of some rude implements: nevertheless it is soon exhausted and he makes his prisoners captured in war to take his place: or perhaps he may be able to hire a neighbour who is stronger or poorer than himself to do his drudgery. Moreover he subdues animals to do the work of men, or he constrains the neighbouring stream or wandering wind to do his bidding. At last, Heat under the form of Steam, is harnessed to the work of cultivation, and is found to be more efficient than all the others put together.

The steam engine wearies not, for it is neither muscle nor brain that works; nor is it like a horse or ox which must be fed whether it works or not; for it eats only when it works, and for

three or four pounds of coal you may have the use of a horse power for an hour.* Easily produced, easily sustained, easily controlled or arrested, steam power applied by proper machinery is the last, best friend of agriculture, as of almost every other art. "The advantage of steam upon a farm," says a recent writer, "is incalculable. It gives speed to every thing connected with it,—smartens the intelligent labourer, assists the hard-working, and keeps the lazy man to his work. It enforces regularity and compels punctuality."

The progress in this branch of the subject, therefore, has been from the use of the muscular power of man to that of animals, applied and enhanced by such machines as horse-powers; then from that of muscles altogether to inorganic forces—from living motors to dead ones—from water to wind, and from wind to steam; leaving to man—the master and thinker, his proper prerogative of applying and directing the energies of that untiring force, which only waits to do his bidding. A ten horse power engine is now employed to drain 1000 acres of fen land in England, and does its work in 240 hours per annum, at a prime cost of 20s. and an annual cost of 2s. 6d. per acre. There are twenty three steam engines on the South Bedford level alone.

In this country, steam has hardly been used as yet, as a motive power, by the farmers. In England however, steam, the motor, is found to be a profitable farm servant, and it is applied to a great variety of purposes. For instance, it is used for thrashing, doing for three pence that which would cost three shillings and six pence by the flail,—in ploughing, draining, and irrigating land, in winnowing, lofting, and crushing grain,—in bruising and cutting roots, hay, and straw, at a saving of 70s. per acre.†

Both in England and America, the steam engine has been employed to drag one, two, or three ploughs after it through the land; but quite recently, the power and the machinery have been cleverly combined, so that the steam-plough is no longer a problem but a reality; and this triumph of art has been effected by a Canadian. Romaine's Canadian Steam Cultivator has secured the most favourable consideration of the best authorities in France and England, and is said to do its work more perfectly and more conveniently than the horse plough, and seems to be applicable to seed-sowing and cleaning land, as well as ploughing. This is certainly a very great advancement.

Implements and Machinery.

In early times, the spade and mattock would be the only implements of tillage, or perhaps a crooked stick, as the natives of New England were wont to use. By and bye, the working part of the

* London News, December, 1855.—p. 726.

† Lectures on Results of Exhibition of 1851, 2nd Series, p. 37.

tool or implement is formed of iron, and it is drawn by horses or oxen instead of by the women or slaves. At these early times, its form is imperfect, and there is but one form for all varieties of work; it has but one handle, and makes furrows both crooked and shallow. Not long ago, the Highland plough was drawn by four horses abreast, fastened to each other by birch twigs; the four halters were attached to a long beam held by a driver, who walked ahead, with his face turned backwards to the horses and ploughman; an attendant pressed upon the beam, and a fourth followed with a spade, to rectify the many deficiencies of the operation.

In England at the present day, many farmers use four or five horses driven in line; the furrow even in light lands does not exceed four inches in depth, and the two men and four horses hardly get over three quarters of an acre per day. In Scotland they never use more than two horses to a plough, except for subsoiling. The plough itself is made of iron or steel; the best form for general purposes, and for every variety of land and work has been ascertained; and furrows may be turned from nine to thirteen inches deep, and from fifteen to seventeen inches wide, when the object is to stir or mix the subsoil with the soil.

The operations of reaping and mowing have within a recent period also been effectively performed by the aid of horse power, and equal praise is due to the artizans who have succeeded in imitating by machinery the complex motions of the mower, the spade-labourer, and ploughman.

Reaping machines were known to the Romans, but the modern form was first suggested in Scotland and perfected in America, where the scarcity of labour for prairie farming seems to have imperatively demanded their adoption: with the steam plough and mowing and reaping machine the prairies of the west may yet become the favourite abode of the Goddess of Plenty.

In this Province, there are probably not more than a dozen mowing machines as yet, but in the United States the demand is ahead of the supply; and no wonder, for with two horses one will mow at least twelve acres a day. The horse drill in the same way will sow seven or eight acres a day and save half the horse work. It has been said and apparently with truth, that the progress of agriculture may be measured by the desire shewn by the cultivators of the land for improved implements and agricultural machinery. Machines are devices for economizing power and applying it to the best advantage; theoretically therefore, machinery ought to be applied to agriculture, wherever labour is scarce or uncertain, and it is precisely this small supply of labour which has stimulated our enterprising neighbours to contrive so many new and ingenious forms of agricultural machinery. The sub-soil and trench-plough, the mole-plough, the cultivator, clod-crusher and

scarifier, the drill-harrow and the horse-hoe, manure-distributor and drain-tile machine, the horse-drill, the hay, straw, and root-cutter, the grain-crusher, the root-grater, the thrashing machine, the reaper and mower, the horse-rake, the potato-washer, the corn-sheller, the hay-press—all these are implements of comparatively modern invention. There ought to be an Agricultural Depot or Museum in this country, where such implements should be always open to public examination.

There is a difficulty in this country, and there will be for some time to come, as to the supply of manual labour. Those farmers who find labourers within their own family, do best, because such labourers cost less, work better, and take their pay in produce. But this source of supply is limited, and the amount of work thus done is also limited; the business of the farmer remains a small business, and the returns are not otherwise so great as they might be.

It seems almost a truism to assert that unless a hired servant or a horse, can by their exertions produce more than the amount of their charge against the landlord, the latter gains little by using their services; it is obvious also that the cost of living is greater in a cold than in a warm climate, while the number of working days is smaller. Now, considering all things, it seems to be still doubtful whether a farmer here can afford to pay his labourers at the rate of £30 a-year with board. In Dorsetshire, where the farm labourer used to get about eight or ten shillings a-week, the point is easily settled, but here, it seems to be still an open question.

If the farm be within easy distance of a cash market, if present prices continue, and if the master can skilfully direct the labours of his servants, I believe that labour will pay at the above rate. As capital accumulates among farmers, and as skill in farming becomes more general than it is, I can assert that the profits of farming will be much greater, the demand for hired labour will increase, and its value will be much better understood.

As an instance of the effect of well directed skill in saving labour upon a farm, I may adduce a farm in Rosshire, of which about thirty years ago, the working strength consisted of sixteen oxen and twenty four small horses. That farm is now laboured, and laboured better, by three pair of horses. Is is also now an established fact that one horse in a Scotch cart is better than two in an English wagon for many farm purposes.*

The foregoing remarks all go to prove the importance of using the motive powers of wind, water and steam, as soon as they can be cheaply applied in farm work, and of supplementing the labour of them and of men and animals by the best and simplest forms of machinery.

* Journ. R. Ag. Soc. 1851, p. 617.

To do that, however, requires mental labour and a better knowledge of the natural forces and natural materials, and of the natural laws by which they are respectively bound; in other words, it requires a better and more special education than is now afforded to our farming population: In fact, a knowledge of the mechanics and chemistry involved in Agriculture ought to be the birth-right of every son of the soil in this Province, and the farming interest ought not to rest satisfied until it has been attained. They have the power to exact it; let us see whether they have the inclination and the desire to make use of their power. The Canadian farmers have, even already, succeeded in placing a Minister of Agriculture in the Executive Government, and establishing a Public Bureau for the superintendence of all that concerns their special wants and interests.

3. *Markets.*

On the subject of Markets little need be said. The markets of the world are now open to us for all our farm produce; but—unfortunately, the home market is not yet supplied. New Brunswick annually imports to the value of about three quarters of a million currency of food such, as is commonly said, may be produced upon its own soil. Contrast this with the case of the United States, where agriculture yields about three fourths of the whole exports; or, with Canada, where it furnishes about one half of them.

The value of our gross imports of farm stuff last year (1855) was as follows:—

Bread,	£2,565	Sterling.
Flour,	334,487	
Wheat,	43,532	
Other Grain,	32,855	
Corn and Oatmeal,	65,930	
Live Stock,	19,696	
Salt Meats,	40,320	
Butter, Cheese and Lard,	21,187	
Fruit and Vegetables,	23,550	
Gross Total in Sterling,	£584,122	
Total in Currency,	700,946	
Net Imports in Currency,	684,161	

To get an idea of the supply of food annually required here by man and beast, we might add the year's imports to the year's growth or production. This however can scarcely be done except for the years of the Census, and it is hardly possible to estimate at all correctly the value of the fresh meats and fish, consumed annually in the country.

I here reproduce* an estimate of the value of our farm produce in 1851, the year of the last Census. These returns, if not strictly exact, are, at all events, the only official ones to which we have access.

	Amount.	Value.
Forage Grasses,	225,093 tons,	£551,478
Wheat,	206,635 bush.	77,488
Barley,	74,300 "	15,634
Rye—say		15,634
Oats,	1,411,164 "	141,116
Buckwheat,	689,004 "	129,188
Corn,	62,225 "	14,014
Pease and Beans,	42,663 "	21,332
Turnips,	539,803 "	31,489
Potatoes,	2,792,394 "	267,604
Other Roots,	47,880 "	5,386
Butter,	3,050,939 lbs.	123,944
Total value in Currency,		£1,394,307

It is to be remarked that these estimates were made up at the prices quoted as the average by Prof. Johnston in 1849. Let us now find the value of the food imported in 1851, and let us estimate the fresh meats at £200,000 for the same year.

The food imported in 1851 was as follows:—

Bread,	£1,294
Flour,	97,932
Wheat and other Grain,	49,000
Corn and Oatmeal,	9,817
Fruit and Vegetables,	8,838
Butter, Cheese and Lard,	3,330
Live Stock,	18,829
Salt Meats,	27,962
Total in Sterling,	£216,002
Total in Currency,	259,202

By combining the three quantities we get, approximately, the amount of farm produce required as food for man and beast:—

Growth of 1851,	£1,394,307
Imports,	259,202
Fresh Meats—say,	200,000
Farm produce required as food,	£1,853,509 Currency.

By the above *data* it would appear that in 1851, the deficiency

* Rep. N. B. Soc. I. 297.

amounted to nearly one seventh of the whole demand, for these first necessaries of life. But, judging by the imports of later years, the deficiency would seem to grow more considerable as compared with the demand. Our net imports of farm stuff in 1854 amounted to £595,513 currency; and in 1855, to £684,161 currency.

The article of farm produce which figures most largely in the imports is always Wheat, in the form of grain, flour, or bread. In 1855, the value of the gross import of wheat was £456,700 currency; that of the net import was £440,509.

To ascertain the ratio of the country produce of wheat to the whole demand for it, we may, first, compare the growth of 1851 with the import:—

Growth, valued at, - -	£77,488
Import—say, - - -	155,071
Total, - - - -	£232,559 Currency.

The growth of the country therefore represented very nearly one third of the whole demand, which would appear to have been about 3¼ bushels per head for each inhabitant of the country. In 1852 Canada exported five and a half millions of bushels of wheat alone.

We may likewise attempt to estimate the ratio of produce to demand at the present time, by adding, say, one tenth to the growth of 1851, and one third to the price (seven shillings and six pence per bushel) at which the former year's produce was estimated. The total will represent, approximately, the native growth for the year just expired, and by adding that to the net import of the year, we shall get the total demand for 1855.

Wheat grown in 1855,	227,298 bush.	£113,649 Currency.
Net Import,	881,018 "	440,509 "
Total,	1,108,316 bush.	£554,158 Currency.

Thus it will be seen that during the year just expired, the country produced about 28,000 quarters of wheat, or one-fifth of what was required, and which was consumed (exclusive of seed) as food by the people of the country. It represents the growth of probably twelve or fifteen thousand acres of land, and would have yielded little more than one bushel to each inhabitant of the Province, or, about ten weeks consumption on the whole year. In 1851, the wheat crop of Canada yielded very nearly 13½ bushels for every inhabitant, and several single Counties in that year produced three times as much as the whole of New Brunswick. I have gone into these details, in order that we may be able to form a definite idea of our actual position as a wheat growing country; unless that be understood, we may at the present time be only making difficulties for ourselves hereafter, or expending our energies in a wrong direction.

On the whole, therefore, I candidly confess that I see little prospect of New Brunswick becoming a wheat exporting country. So far from that being the case at present, there is as we have seen, a deficiency of four-fifths of what is actually required in the home market. Moreover, I am not sanguine that either wheat or Indian corn—the great food grains of North America, will ever become the general or staple crops of New Brunswick, or that they can be raised here at a price which will allow them to compete abroad with the same articles grown in New York, Ohio, or Canada West.

But if we cannot grow wheat enough to export—which is certain; nor enough to supply the whole of the home demand—which is uncertain; we may at all events, grow enough within the country to feed the farming portion of the community, which probably represents about one half of the whole number of inhabitants. There surely need be no difficulty in supplying one half of the home demand: but in order to effect even this moderate result as soon as possible, we ought to diminish the demand for wheat in the meantime, by a partial substitution of oats or of some such grains as are the true staples of the country, and at the same time apply greater energy and greater intelligence to the business of farming. To encourage us in this undertaking, it may be well to know that within the last ten years, the growth of wheat in Canada has increased 400 per cent. To supply even the half of our present home demand, implies nevertheless, more than doubling our present production—a result attainable only by the application of more labour, or more intelligence and devotedness to the business of farming; and farming as a business, implies at least maintaining if not increasing the native fertility of the soil.

Under *our* present actual circumstances, a few days labour at a boom or mill-pond brings enough wherewithal to purchase a barrel of American flour; and the silver dollar *near the eye* of a settler, as it has been expressed to me, so conceals the view of his distant farm, that when the fall of one penny per foot for lumber in the markets of Liverpool throws him out of employment, he is surprised to find his fences down, his fields grown up with bushes, and both himself and his snug little clearing generally, *all gone to the bad.*

We want therefore in the first place, more labour, so that there shall be enough both for farming and lumbering purposes; and in the second place, we want such labour as we have, or may get, to be directed to the work of agriculture, with greater knowledge of its bearings as an art and a science. The cutting down of trees or the handling of deals, is a business as purely mechanical as can well be imagined; but farming, I mean successfully directing the details of farm operations here or elsewhere, requires quite as much

headwork as handwork. Now, seeing that the majority of our farmers both *direct and do* the work of the farm, there ought to be means provided whereby they may arrive at a knowledge of those principles of agriculture which precede and direct practice, in every climate and on every soil, by some method less dilatory and expensive than the old-fashioned one of *trial and error*.

In Prof. Johnston's Report to the Government, which, in many respects, is an admirable document, the agricultural capabilities of the Province have been somewhat unduly exalted: at all events, the prospects of wheat culture as a remunerative investment in New Brunswick are therein much more highly coloured than, in my opinion, experience will justify.

From the statistical data which Professor Johnston made use of, more particularly, the produce per acre, the weight per bushel, and the money value of an acre of wheat in New Brunswick, Ohio, and Canada West, respectively, he concludes (p. 91) that that grain can be raised more cheaply here than there. A leading London Journal not long ago made use of agricultural statistics such as the above to show that the north of Scotland, (Caithness, &c.) was more successful as a wheat growing country than the south (Lothians, &c.) But, if the fallacy had been sought for and eliminated in the case, it would have appeared that the cost of the production of one hundred thousand bushels of wheat was considerably greater in the one place than the other: in other words, that the labour of one man would not have gone so far in the one case as in the other, and that the *net* income accruing from the operation would have been comparatively smaller in the case of the north of Scotland and New Brunswick, on the average of years. Such cases however serves to show that labour and skill may go far to make up for natural disadvantages of soil and climate. Professor Johnston, furthermore, asserts that the money value of the produce per acre ought to measure the value of farms in New Brunswick, Ohio, New York, and Upper Canada, respectively; and he quotes the average value of an acre of wheat in Ohio at less than half of that of an acre of wheat in New Brunswick. But, I would ask, what enables the Ohio grower to sell wheat at half the price of New Brunswick wheat, and he must still be supposed to be doing so at a small profit? It is, I presume, because the cost of production in Ohio is proportionally less; for the value of wheat in the long run always conforms to the cost of its production, that is, the labour and skill required to bring it into the market. Moreover, the price of Western wheat regulates the quotations in our Eastern markets; and, obviously, the true standard of value, in the case, ought not to have been the *gross* revenue, but the *net* revenue from the produce of one acre of land. Professor Johnston's figures, in this instance, might have been used to prove the reverse of what

he intended. We here can only strive by higher farming to maintain a market which is always at our own doors, against the greater *natural* advantages, or superior productiveness of the soil and climate of the West, as regards wheat and indian corn. Experience seems to show that wheat to be cultivated on the large scale, and successfully, must be cultivated as a winter crop; and, wheat as a winter crop in New Brunswick is now almost entirely abandoned. On the other hand the climate of Canada West and of the Western States is perfectly adapted for winter crops; limestone abounds there, the soil is deep and fine, and the surface generally free from boulders and rocks: These latter are rather abundant in the country which lies to the northeast of the Hudson River; and, as a general rule, limestone is deficient in the soil of all the tract last mentioned. As compared with New England the Province of New Brunswick has somewhat the disadvantage of latitude, but it is more completely surrounded by water which somewhat tempers and equalizes its climate; its surface is less mountainous and abrupt than that of any equal area in New England. It presents a greater and better variety of rocks, out of which its soils have been formed; calcareous slates and red sandstones, limestones and plaster occupy an extensive surface within its limits; and it presents many great plains, fertile valleys and intervales, with much rolling upland nearly free from stones, and supporting a noble growth of hardwood in a deep black soil.

The natural conditions of a country, that is, its latitude, elevation, and soil, must always determine the broad characters of its agriculture. The hand of Providence thus marks them out. These natural conditions influence, not only the distinctions of the staple crops of every country, but they also regulate to some extent the elements of a rotation in each individual locality. Thus, there are upon the globe what may be called *zones or belts of different crops* placed there by man, but only because Providence has so prescribed it. Taking Russia, for instance, as a country where several such zones can be seen together, we find that they are thus arranged from south to north:—

1. Sugar, Olive, Silk culture.
2. Corn, Oil grains, Tobacco, Vines.
3. Wheat and Garden fruits.
4. Rye, Flax, Oats.
5. Barley.
6. Forests and Cattle rearing.

In North America, again, it is easy to distinguish at least three such characteristic belts of cropping, laid out by man, but previously arranged for him by the same Power which prescribed the natural growth of trees, plants, and animals under analogous circumstances. The limits of these artificial forms of vegetation

often encroach upon each other, and, by high art and skill may be made to overlap even more than they do now; but, they are substantially as follows:—

1. Sugar, Cotton, Tobacco, Rice; in the Southern States.
2. Corn, Wheat, Rye, Hemp, and Flax; in the Middle States.
3. Oats, Barley, Buckwheat, Hay, and Roots; N. E. of the Hudson River.

These distinctions in the *staple or certain crops* of each country, as already said, depend upon natural causes, that is, upon conditions ordained by Providence to produce variety upon the earth itself, and unity among its inhabitants, who thus are all made dependant upon each other, and, as it were, invited towards a reciprocal interchange and participation of benefits and commodities one with another.

This special adaptation of the earth to different crops so operates, that the cost of the production of such crops within their proper limits, is on the whole smaller there than elsewhere; and accordingly such crops can be sold cheaper to the consumer. It is, therefore, of the first importance that we here, as elsewhere, should select such crops as are naturally *best suited* to our climate and soil, so that our investments in agriculture may be safe, and our returns certain, from one year to another. Already, I am glad to say, the movement has set in towards roots, oats, hay, grass seeds, and the rearing of sheep, cattle, and horses.

It is difficult to foresee the *whole* effect of Railroads, and Reciprocity Treaties, and Colonial Unions, upon Agriculture; but, it seems probable that, inasmuch as they all necessarily operate to overcome physical or political barriers to the free and fair interchange of the natural productions of different countries, they will hereafter cheapen Canadian or American wheat to us, and, *by so much*, cause wheat culture to retrograde in New Brunswick. The culture of sugar has, in this way, nearly altogether disappeared from the shores of the Mediterranean, although the climate now is quite as good as when it was a staple article of cultivation in that quarter. Free trade therefore certainly tends to limit crops to those places where they can be grown cheapest, that is with least artificial treatment, or least cost to the producer.

Nevertheless, although we may not be in the most favourable locality on the Continent for wheat or corn culture, there remains quite enough to keep us all occupied, and, perhaps, as pleasantly and profitably occupied too as if we had a soil and climate equal to that of Ohio or Canada West. If these countries have a climate more favourable to agriculture, we have one which is far more favourable to health, and active exertion, which is the chief pleasure of life: We have not the overwhelming heat, and the miserable fevers which pursue the languid settlers on the soil of the West.

If these countries have a market with us for their staple productions, we have a market with them, or others, for our own; and, where nature has treated both parties evenhandedly, *we* must try to win the race by the application of greater skill and energy in the development of such resources as we actually possess. To think otherwise is to forget first principles.

If a statesman should desire to favour the culture of wheat within this Province, so that our farmers should have the undisturbed monopoly of the home market to themselves, he might, first, offer a bounty upon its production here; or, he might lay a duty upon its importation from abroad; or lastly, he might increase the balance in favour of the native grower by perpetuating all the natural obstacles which exist to the cheap transit of foreign grain; I say he might do so for wheat as for other things, but I do not defend the policy of such conduct, because I do not believe that it would be justified by experience; in fact these devices have all been tried and rejected already. There remains little more than the tradition of them.

Already the farmer, the pure farmer, begins to look more satisfied with himself than the hybrid operator in spruce logs; and free trade for the present promises to result in higher prices for farm produce, though not for wheat; higher prices will result in higher farming, and a demand for a better knowledge of its principles and practices. Free trade in England at first brought *lower* prices for native produce; but as skill and capital abounded there, these were soon compensated by the increased productiveness resulting from higher farming. Increased energy, directed by agricultural chemistry, and aided by the timely introduction of guano and bone dust, alone averted the temporary ruin which seemed to be impending over English agriculture, by the abolition of import duties on foreign grain. Rents are now actually higher and the profits on farming greater than at any previous time.

If *we* cannot maintain our own market against remote competitors, who may be *naturally* more favoured than ourselves, it is time that we knew it; but, in my judgment, the point cannot be fairly tested until we have directed our working forces by a better knowledge of their modes of application. *The man who uses a lever and knows how to place it, will raise a heavier weight than another, who ignores the implement and its applications. Head-work and hand-work ought always to be mated together.*

Transit.

The state of our internal communications in New Brunswick is very fair, that is, they are fully better than elsewhere in North America, where there are no railroads in operation; but our distances are great, and a more speedy system of transit to market is

desirable. The back settler generally has a market in the lumber woods, with good roads over the smooth surface of the fallen snow. Back settlements indeed, are often mainly dependent upon this kind of market, which, unfortunately however, induces the farmer to enrich the forest at the expense of his fields. If, as he alleges, he gets at once a good money return for his produce there, I can only reply, "True my friend, *but do not kill the goose that lays the golden egg.*" After all, the back settler who thus manures the log crop instead of the turnip crop, is not to be more blamed than he who manures the streets of the city, or the waters of the harbour of Saint John, while exhausting the soil of his own farm in the country.

Our bye roads are extending and improving every year; we have more than 1600 miles of great roads, we have abundant water carriage, and there is steam power on most of the navigable rivers; we have, in short, very tolerable facilities for the *distribution* of agricultural produce.

But, as already said, cities and towns are not numerous, and the distances between them are often truly *magnificent*. Accordingly, a Railroad is greatly to be desired, were it only for the saving of time; for time is money. A railroad, moreover, would cheapen the price of materials (such as iron, lime, and manure,) to the farmer, take away in exchange his produce at all times of the year, and effectually draw the rural districts into closer connection with the centres of commerce, both in and out of the Province. By thus bringing fertile land at all times within easy reach of an adequate market for its produce, the demand for such produce would be increased, and farmers at a distance enabled to raise such things as are only justifiable in the vicinity of a city—such for instance, as fat cattle, roots and vegetables, fruit, milk, and veal. At present he has to put his produce into less profitable forms, such as grain, lean cattle, cheese, salt butter, salt meat, and wool.

The bearing of Railroads upon Agriculture has been well stated by Mr. Andrews:* "It is well known," he says, "that upon ordinary highways, the limit to transportation is confined within a comparatively few miles, depending of course, upon the kind of freight and the character of the roads. Upon the average of such ways, the cost of transportation is not far from 15 cents per ton per mile. Estimating at the same time the value of wheat at $1.50 per bushel, and corn at 75 cents, and that 33 bushels of each are equal to a ton, the value of the former would be equal to its cost of transportation for 330 miles, and the latter 165 miles. At these respective distances from market, neither of the above articles would have any commercial value, with only a common *earth* road as an avenue to market. But we find that we can move property upon

* Rep. on Colonial Trade, 1852, p. 380.

railroads at the rate of 1.5 cent per ton per mile, or for one-tenth the cost upon the ordinary road. These works therefore extend the economic limit of the cost of transportation of the above articles to 3,300 and 1,650 miles respectively. At the limit of the economical movement of these articles upon the common highway, by the use of railroads, wheat would be worth $14.50, and corn $22. 27 per ton, which sums respectively would represent the actual increase of value created by the interposition of such a work. The value of lands is affected in the same ratio as these products. For instance, lands lying upon a navigable water course, or in the immediate vicinity of a market, may be worth for the culture of wheat, $100. Let the average crop be estimated at 22 bushels to the acre, valued at $33, and the cost of cultivation at $15: this would leave $18 per acre as the net profit. This quantity of wheat (two thirds of a ton) could be transported 330 miles at a cost of 10 cents per mile, for $3.30 which would leave $14.70 as the net profit of land at that distance from a market when connected with it by a railroad. The value of the land, therefore, admitting the quality to be the same in both cases, would bear the same ratio to the assumed value of $100 as the value of its products $14.70 does to $18, or $82 per acre; which is an actual creation of value to that amount, assuming the correctness of the premises. The same calculation may of course be applied with equal force to any other kind and species of property."

Mr. Andrews, in treating of the income of railroads in the United States, goes on to say (p. 386) that the purely *agricultural* lines in New England do not pay, but only those which connect towns and manufacturing localities. In the Southern or Western States again, *agricultural* lines do pay, because, the soil there often supplies, per mile, a greater *bulk* for transportation than is supplied to Eastern roads from agriculture, manufactures, or commerce.

In the old country, roads and canals first, then steamboats and railroads, have revolutionized agriculture, and this revolution is now in progress in the United States. The conveyance of grain, milk, butter and cheese to the Atlantic seaports is one of the chief sources of railway dividends; so that lands many hundreds of miles from New York, where the net returns from the richest crops were formerly insignificant, have now acquired a value almost equal to that of lands in the suburbs of the City; they have increased tenfold in value. The same is the case in Canada: when the Great Western Railroad, which connects New York with Canada West, was opened, on the very day of opening, farms along the line became doubled in value.

But apart from all foreign considerations, the railroad whistle here—like that of Roderick Dhu—will fill the forest with living, energetic men, while its echoes will arouse the slothful and evoke a

thousand schemes of improvement now undreamt of, but all ultimately accelerating the progress of agriculture in New Brunswick.

Before concluding this portion of the subject, I may offer some general observations upon the peculiar position of this country as regards an argument which is often pressed without limitation; I mean the immediate necessity for *high* farming here, in order to do full justice to the agricultural capabilities of the country, and the amount of blame due to settlers for not having already generally adopted it.

Farming may be called *high* or *low*, according as the farmer strives by dint of labour and capital to keep the land in the most fertile condition, and draw the highest income from it; or, as he tries with smaller means to arrive more gradually at the same result. In the one case, the course of the rotation is short, and manuring frequent and heavy: in the other, there are at all events more than four crops in the rotation, and a certain productiveness is even maintained without manuring at all. Hop culture, market gardening, and spade husbandry, illustrate the *highest* kind of farming; while grazing or sheep farming are of the *lowest*. The former is practised where labour and capital abound; the latter will be pursued under circumstances where labour and capital have for the time a high value as compared with land, or, in countries where the markets are remote, and the population limited and deficient in agricultural knowledge. The soil has little influence in the case, for some of the highest farming in England is carried on profitably on the poorest soil. Either one or the other system is good, that is, profitable according to circumstances: in the one case, the gross revenue may be great; in the other the net revenue may be the largest, on the whole.* In this country, high farming is little known as yet: in the old country it is extending every day: English examples are not, therefore, always the best for us, and English criticisms on our condition are not necessarily infallible: Much of what is written for England is in fact unsuitable here, and a cautious adaptation of English practices is required; for, after all, I may venture to say that farmers here are quite as anxious to be in good credit with their banker as they can be in England. In England, they demand incessantly an increase of agricultural science; what we chiefly require here at present is *the diffusion of principles already established.* High farming ought always to be our aim here, but it must be taken up with care and judgment, and perhaps may not become general, until labour is more plenty and railroads in active operation. In New Brunswick, a mixed system, or compromise between grain husbandry and pastoral husbandry, is the rule; that is, an indifferent alternation of crops is followed for six or seven years; after which, grass is cut or pastured for an

* Goeritz, Cours d'Economie Rurale, 6.

equal period. Such is the practice which prevails most generally in the country, but, in numerous instances a shorter and better rotation is steadily and profitably pursued. Our first aim ought to be to learn to make or save manure enough, so as to shorten or do away with the long fallow, and restore fertility to our arable land in a shorter space of time than at present.

While acknowledging on the one hand, the great progress in agriculture which has of late years taken place in this respect, in some parts of the Province, I see again but little advancement in others; nevertheless, I am not disposed, as many are, lightly to disparage our new settlers, on account of the magnitude of their clearings and their comparative unproductiveness. It seems to be the result of necessity rather than of design. These clearings have been enlarged, not simply because the owner meditated a greater breadth of cropping, as previously stated, but because he was compelled to do so, inasmuch as he could get no more crops from the land which had been cultivated. Nay, how could he do so? He brought with him into the dark forest many years ago, we may suppose, only a wife as young as himself, a cow and a pig, an old horse, an axe, and a grindstone. Such were the first settlers; such were their agricultural implements and farm stock. By a strong and willing arm, the forest was speedily cleared to the extent of a few acres, and the new settler got a little cash for all that he could spare of his first, best crops, from a lumber party in the neighbourhood. Indeed I believe, he often hired out to them himself, and found the old camp life as jolly as ever. Sooth to say, most of us would have done the same. But, having no chance of buying manure, and having sold his hay and oats off the farm, he could have little manure upon it; and, having but poor accommodations as yet, the manure which was made had long ago yielded its tribute of nitrogen to the wind; while its phosphates and alkalies, borne away with the passing brook, bade good bye for ever to our friend, who at the moment was too much interested in stream-driving, to think of such trifles; nevertheless, that winter's work *paid* as well as the summer's had done. A poor chance enough for high farming and stall feeding, you will say, and I agree with you. Accordingly, our friend goes on cropping and chopping alternately, while he leaves the old fields to recover by a most tedious (but economical) process of fallow or pasturage. Thus he slowly progresses towards independence; and if he has not staid away too long from his farm, fiddling and stream-driving, and so forth, he finds himself at length the unquestioned lord of a large clearing, and with an ample inheritance for his children for ever; that is, if they will only try to avail themselves of its proper productiveness. It is obvious therefore, that in the first place, our clearings must be large, and their produc-

tiveness comparatively small; *and that from the nature of the case.* Those large clearings now await the application of skilled labour, and are ready to reward it.

Immigrants with money, who understand farming and design to pursue it as a business, need not go through the process above described: they can almost always buy cleared land, including both meadow and upland, at a moderate price, or they can hire the country people to prepare the land for use. We therefore invite those whose health and strength is their chief capital, to go upon new land; while immigrants, possessed of a little ready money, and understanding of agriculture, are recommended to buy ready made farms; and by *manure and management*, restore to them fertility, and lay broad the foundations of comfort and independence for themselves and families, in all time to come.

II. *On the Progress of Agriculture as an Art.*

Having now offered some reflections upon Land, Labour, and Markets; having demonstrated the progressive improvements which have taken place in the tenure of the land; in the addition of new motors, in the greater efficiency of labour aided by modern implements and machinery; and in the extent of our markets and the facilities for reaching them,—we may next advert to the progress of the art itself, and to that of the science of Agriculture.

The origin of Society and the primary occupations of mankind have already been spoken of; it will now be easy to understand that the art of agriculture having once been established, would advance at very different rates according to the natural differences of soil and climate, and the genius of the people. The isolation of races, in these early times, would naturally lead to different and special developments of the art, and prevent that general march of improvement which simultaneously affects the arts of every country at the present day.

The classic nations of antiquity, who dwelt upon the shores of the Mediterranean, possessed a climate peculiarly favourable to agriculture. The soil of Greece, however, was broken and mountainous; and the Greeks were, and continue to be more particularly a seafaring people. Italy, on the other hand, presents a more level surface; and, after war, agriculture was the great business of the Roman people.

Romulus divided the territory which he conquered, among his *filibustering* followers. At first, the lots were only of the size of one acre apiece; at a later period however, conquered lands were distributed in three acre lots, and no soldier or citizen was allowed to possess more than five or six hundred acres. This was the general rule until a very late period; and, with absolute ownership in the soil, each citizen vied with his neighbour in striving to promote its fertility.

The Romans, according to Pliny's account, ploughed their fields with the same diligence that they pitched their camps, and sowed their corn with the same care that they arrayed their armies in the day of battle. No wonder, then, that corn was abundant, and that the Romans were occasionally able to supply the deficiency of other countries; and, with their conquering armies, to carry improved practices into Gaul, Belgium and Britain.

I do not propose to enter into the details of agriculture of the Romans; but, it may be interesting to quote some of their precepts as a proof of the ea ly civilization of that great people.

"What," says Cato, (B. C. 200) "what is the best culture of land? Good ploughing;—What is the next best? Ploughing as well as you can;—"What is the third? The application of manure!"

"The use of ploughing," says Theophrastus, "is to let the earth feel the cold of winter and the heat of summer; to invert the soil and render it free and clear of weeds, so that it may afford a full supply of food to the plants."

Their management of manure was better than that of many New Brunswick farmers. They carefully collected materials for the manure or compost heap from all quarters. They used lime and marl, and top dressed with pigeon's dung, as we do at the present day with guano, which is the dung of sea fowls. "Lands, which have been manured with wood ashes," says Palladius, (A. D. 380) will not require manure for five years.

"I know" says Columella (A. D. 12) "that there are farms where neither the dung of cattle nor of birds is to be procured; and yet, even in such places, he is a slothful farmer who can find no manure. He may collect any kind of leaves, the cuttings of briars, and the rakings of the roads, and mix them with the cleanings of the court yard."

"You may make manure," says Cato, "of lupines, corn stalks, chaff, holm, and oak leaves." From the corn fields pull out young alders, tall grass and reeds from the willow grounds, and lay them below the sheep and cows.

In mowing and reaping they used machinery, as we are now beginning to do; and, as to the period of doing so, their standard rule was, "Better two days too soon, than one day too late." "Sow less and plough better," was another sound maxim. "Admire a large farm and cultivate a small one." "The land ought to be weaker than the husbandman." "Whoever would buy a field, let him sell his house, lest he delight more in the town than in the country." "Do not be in a hurry to build," says Pliny, "It is best to profit by the folly of others." These are all good and wholesome doctrines.

"In regard to breeding," says Virgil, (B. C. 30) "you must attend principally to the make of the mother. If any one, fond of the Olympic games, breeds horses, or, if any one breeds stout bullocks for the plough, he chiefly attends to the make of the mother, and she ought to be of a large frame."

"To break bullocks," says Varro, (B. C. 120) "put their necks between forked stakes, and give them meat from the hand; then in a few days you may join an unbroken one with a veteran, whom he will imitate; then let them go upon some new ground and afterwards upon sandy land with a light plough."

"The good points of an ox," says the same writer, "are spacious horns, rather black than otherwise, a broad forehead, wide nostrils, a broad chest and thick dewlap." "The signs of merit in a colt," according to Columella, "are a small head, flat limbs, and contention with other colts or horses in running, or in any other way."

These quotations may suffice to illustrate the condition of Roman agriculture about two thousand years ago, and to prove that even now a classical education need not be wholly thrown away upon the sons of the soil of New Brunswick. But, the example of Roman agriculture passed away with the Empire, and, in Great Britain, at least, no use was made of their precepts—unless by the Monks, perhaps—until within a vey recent period.

The first English work on agriculture was written, in the reign of Henry VIII, by Sir Anthony Fitzherbert, (1532); and, from that period, improvement in English agriculture may be said to date.

It would be well that Sir Anthony's Treatise on Husbandry were studied occasionally at the present day. As a sample, I shall quote his outline of the duties which he prescribes for the wife of a "yonge gentleman that intendeth to thryve."

"It is a wyves occupation to winnow all manner of cornes, to make malte, to washe and wringe, to make heye, shere corn, and in time of need to help her housband to fill the muck wayne, or dounge cart, drive the ploughe, to loade heye, corne, and such other; and to go or ride to the market, to sell butter, cheese, milke, egges, chekyns, capons, hennes, pygges, geese, and all manner of cornes."

Another maxim from Sir Anthony's book is worthy of quotation, "A housband cannot thryve by his corne, without cattell, nor by his cattell without corne;" adding, "shepe, in myne opinion, is the most profitablest cattell that any man can have." This last sentiment especially ought to be gravely considered here. England was, for a long time, remarkable for its flocks of sheep; and wool was one of its chief exports to foreign countries: but, the art of agriculture generally was in a backward state until about the beginning of the last century. The introduction of clover, potatoes, and turnips as field crops about that time, of rotation in cropping,

of deep drainage, of drill husbandry, improved breeds of stock,—each of these was an epoch in the history of the art, and will require some special observations: alternate husbandry had now superseded the almost purely pastoral agriculture. The art of agriculture all this while kept in advance of the science, for it was not until after Chemistry, Physiology, and Geology had made some progress, that science could be properly applied to agriculture; and even for a long time afterwards, its chief efforts would be directed to understand the *rationale* of the most successful practice of the day.

As the demand for agricultural produce extended with the growth of manufactures and the increase of population, the necessity for gathering, sorting, and disseminating the results of agricultural experience, led to the formation of societies in England, Ireland, and Scotland, and to the publication of books containing wholesome directions and profitable suggestions for the use of all concerned. From these sources, Agricultural Literature or Book-farming arose; but instead of Annual or Quarterly Journals, there is now a ceaseless call for monthly, weekly, or even daily records of agricultural progress, and hints from science towards improvement: and, this diffusion of knowledge among the agricultural community at the present day, is one of the most powerful incitements to improvement and progress. Of course there is, and ever will be much that is imperfectly known in agriculture, as in other things, and much that is unknown; were it not so, where would be the pleasure of study, and the delight so intense and pure, which attends upon the discovery of the plan or system which God has established in Nature? I say much more is unknown, probably, than has as yet been discovered by man; but a great body of truth *has* been discovered, concerning the laws of nature which bear upon the pursuits of agriculture. These truths or laws by which God has bound himself as regards the soil, and the atmosphere, and the fabric of plants and animals,—these facts and comprehensive truths are now to be had, briefly stated and embodied, in works of science applied to agriculture, and no farmer can wisely or profitably neglect to study them; a neglect of them, in fact, is indicative of folly as well as ignorance. These works profess to declare, "by what means, and on what terms, the fruitfulness of the earth, and its invaluable products may be forever maintained, if not forever improved." It is more than time that our rural population learnt to understand the language in which they are written—and to read them.

As we can only refer to the leading points connected with the advancement of the Art or Science of Agriculture, we may condense the observations, which it is proposed to offer upon the first of them, under the heads of Drainage, Manures, Rotation of Crops and Stock Husbandry.

1. *Drainage.*

The removal of water from land had been practiced from very early times, but its full importance has only been recognized of late years.

The reasons for draining, and its advantages, are better understood than they were; and the art of draining, as now practised in England, is something very different from what it is here, or from what it formerly was in the mother country.

Thorough drainage is now considered to be the first requisite towards good farming; for stagnant water not only keeps the soil cold, but it renders it poor, or comparatively sterile also; so that crops sown upon it pine, and starve both from cold and hunger: it deprives land of its proper fertility.

Let us examine it a little more closely: the heat of the sun is required to assist in all the processes, or minute changes which constitute growth. You may as well try to roast mutton without a fire, as to grow crops without solar heat. Now, in countries called cool, or temperate, there is barely enough of heat for the purpose of growth; and, if the soil be waterlogged, the heat of the sun is chiefly expended in converting the water into vapour or steam,—in giving a new form to water, rather than in raising its temperature: that is to say, the presence of water in the soil deprives heat of its warming powers, and thus deteriorates the *underground climate*, so important for growing crops. The most favourable temperature for growing crops is between 60° and 90° Fah.; but, as waterlogged land is generally from 10° to 20° F. colder than well drained land, a New Brunswick farmer cannot afford to leave his fields at so great a disadvantage as the want of drainage would imply.

Supposing one half of the rain which falls upon the ground here (about 40 inches per annum) to be again evaporated, while the other half passes downwards into the ground; it has been calculated that more than four hundred tons of coal, per acre, would be required to evaporate that portion of the rain-fall, which is thus annually converted by the sun's rays into steam.

By draining, the water passes downwards through the soil, rather than upwards again into the atmosphere. And the suns rays go to warm the soil, rather than to generate steam. Water is a good thing—the best of things—it is the chief food of plants, but too much of it in land is a standing evil: It is a good thing out of place.

Moreover, the drainage of land adds directly to its fertility. By fertility, I mean the ability to supply food for the growing crops, of the proper kind and condition. A very large proportion of the food of plants comes from the atmosphere, and no soil can possibly be called fertile which does not permit air and water to pass freely through it. Water dissolves air; air and water together dissolve

part of the elements of the soil; these, again, constitute the food of plants; and they ought at all times to be filtering slowly past the roots of the growing crops, in order to feed and sustain them.

But, furthermore, air assists in the decay of manure, and in the preparation of the alkaline and other mineral elements of the soil, which, as well as the manure, go to build up the body of the crop. In wet land, therefore, the soil is colder and the season shorter; the slow movement of air and rain water through the mass arrests the supply of food from the atmosphere, while the solution of the mineral food of the plant is vitiated or obstructed in an equal degree.

The water, which flows through the soil in open land, filters slowly downwards until, by some obstruction, it is forced again to find its way to the surface as *a spring*, thus rendering the lower fields spongy, cold and unfruitful. In early times, wet or water logged lands would be shunned, but by and bye they would be taken up. Ditches and open furrows would be the first remedy; at a later period, covered drains, with *brush* or stone. In some cases these remedies would suffice, in others they would fail: Even at the present day, it is estimated that, twenty two millions of acres, or, about one half of the whole arable land of England is unsufficiently drained and unproductive.

About a century ago, a Warwickshire farmer, Mr. Elkington, found that his sheep died rapidly of rot on certain wet and boggy pastures; so he set about draining them in the usual way. The field had a clay soil, kept wet by springs from some clay and gravel beds above it: So he trenched or cut down to the upper margin of the wet ground to the depth of five feet, but still failed in reaching the main source of the supply. Desirous of ascertaining the nature of the strata underneath, he seized a crowbar and forced it down four feet farther; as he withdrew the bar, a rush of water followed, and continued to flow for some time.

Hence the principle was established, that the wetness of land might arise from sources far below the ordinary drains, and which could best be reached by boring or tapping. So important was this principle considered, that the Parliament of that day awarded £1000 to Mr. Elkington for his publications on the subject of Draining.

His rules of practice are simple enough; First, find out the main spring or cause of the evil: second, search for the rise of the spring in the highest part of the field; take its level and determine the drains and branch drains from that point; third, use an auger or crowbar to tap the spring when the spade is insufficient.

In many cases however, perhaps in the majority, the evil arises both from a true spring, as well as from surface water penetrating a strong soil which holds the water incorporated with its own particles—as in the case of dough, or pure clay.

To remedy this condition, Mr. Smith of Deanston suggested, in addition to the ordinary draining for the springs, what he called *furrow draining*, that is, numerous, narrow, parallel drains with furrows between 24 and 30 inches below the surface, and at distances between 18 and 40 feet apart. At first, he used small stones, but afterwards tubes or pipes (*tiles*) of baked clay of 1 to 3 inches diameter, and evenly laid along a narrow trench, carefully levelled, and prepared for the purpose. His suggestions were generally acted upon in Scotland and England, and, in most cases, the increase of the crops, due to the extension and improvement of their feeding grounds, more than paid for the expenses of the operation. The subsoil, in fact, had become available as well as the soil itself. But, when the importance of *stirring and pulverizing the soil, as deeply as possible*, came to be understood; when farmers had fully realized the fact, that by deepening the soil one inch below the old mark, there was added, on every acre, one hundred tons more of feeding ground for the crops; and, after the subsoil plough was contrived to carry out the new principles, it was found that this implement often disturbed the nicely laid line of tile drains, and they gradually ceased to be so effective as they had been at first.

Mr. Parkes now came to the rescue, and suggested that instead of laying the drain pipes at 2 and 2½ feet, they should be laid 4 and 5 feet from the surface.

Deep drainage,—say, from 3 to 5 feet in depth and laid from 6 to 12 yards apart, along the steepest lines is now recognized as the correct practice. The heaviest brick clays, in this way, are easily ploughed, and become capable of growing either wheat or turnips; and thousands of acres of fen or bog land become centres of fertility. But the expence of the modern system, you will say, is very great: True! but, in England the increased productiveness of the land is a sufficient remuneration. The operation is found to pay there. We have done little furrow draining as yet, and less tile draining, and it is probable that for a long time, stone or brush, or wooden drains, will be most generally used in New Brunswick. The question of *material* is, after all, a local one.

Under-drainage is now recognized as an obligation of the landlord, and not of the tenant, who is charged only a somewhat higher rent for this improvement of the soil. Moreover, there are public grants of money in aid of drainage operations, payable after a given term of years; and wealthy companies are incorporated by law, who undertake the whole work of draining estates: the term of repayment being 22 years, 25 and 50 years; or, the charge remains in perpetuity against the estate.

The price of labour at the present time is estimated at seven pence per rod, and the pipes twenty two shillings and six pence per thousand.

The charges for under-draining one acre—

At	18	feet, amounts to	£7	18	4 Sterling.
"	24	" "	5	19	8
"	30	" "	4	16	5
"	40	" "	3	12	1

The grants of public money towards the under-drainage of Great Britain amount to about £4,000,000. Of this sum, Scotland has lodged claims for more than one half, while England and Wales claim somewhat less than the other. This is done, I apprehend, because *farmers* know, or believe that it will pay.

Such is a short outline of agricultural progress under the single head of Land Drainage.

2. *Manures.*

Manuring the land, means or implies feeding the crop; and manures are only food for the crop. Barn yard manure, stable manure and night soil, are chiefly constituted of gaseous materials. This may be shewn by burning a portion, or leaving them to decay, which is chemically the same thing as burning them: in either case, a very small residuum of ash, or solid mineral matter, will be left behind.

But it may be shewn experimentally, that if the soil be sufficiently fine and dry, and if a small proportion only of the required constituents of manure or crops be present in the soil, the more bulky ingredients of the crop or the manure, will be furnished by the atmosphere or by the soil, or by the water filtering through the soil: that is, the application of manure, practically, reduces itself to the application of three or four out of the many elements which constitute the food and the fabric of crops: if some of the others be supplied with these few, the crops will grow rather faster and better than if they were given alone; but, if they should be wholly absent, even though all the others are present, the crops cannot advance or come to perfection, and the land is said to be sterile and unproductive. Such is the *rationale* of manures; such is the principle or theory of fertility, as it is apprehended at the present day.

But many centuries had passed before this simple doctrine could be established, and its important bearings upon practice are not yet fully known to many of those who are most interested in thoroughly knowing and applying it.

It would soon be found by experience, that even on *virgin* soils, after a few harvests the usual crops would refuse to grow; the land seemed to be tired of producing crops, and was considered to be sick or exhausted. Rest and a stimulant were prescribed for the farmer himself in a similar case, and why not doctor the farm, in the same way? This rest was termed *a fallow*, and *manure*

was the stimulant. This is a very pretty and simple speculation; but it is unsound, and is now altogether abandoned. Nevertheless, when the modern theory, which is the sum of all experience hitherto, has superseded the old notion of rest and stimulants, these phrases affect the common agricultural creed of the country. But, be it understood, that the exhaustion of soil is not, in any respect, akin to the exhaustion of the brain or muscles of men; and that manure does not stimulate the *weary* particles of the soil to go on to bear fresh cropping. The analogy is false; and an unsound principle most commonly leads to an imperfect practice. Manure is, as already stated, merely the food of plants; and the soil gets as much *stimulated* by the presence of manure within it, as the plates upon the table are stimulated by the contact of roast mutton and potatoes. You may stimulate a Dutchman—it has been said—to deeds of daring by alcoholic potations; but, I never heard of the stimulation of case bottles or wine glasses.

Knowing that manure is food, or yields food on its decay, we ask the Chemist, what is the nature of the food so yielded by the manure? He informs us that manure, on analysis, yields twelve or fourteen different elements, and that these coincide, almost exactly, with the elements which he finds in the analysis of common crops.

The truth begins to appear: Manure yields food for the crop; and the crop is built up from the elements which are offered in the manure. Plants find their food in the soil naturally, and, as they decay, their remains go to sustain the next year's growth; but, in artificial cropping, the produce is sold off the farm, or it is fed out to animals; and hence, we must bring back an equivalent of mineral manure to the soil, or of the cheapest available forms of anything that ever was a plant, or that fed upon plants in any shape or sense; provided these can be *readily* brought to a state of decomposition or decay. The general principle is, that whatever has been a part, or product of a plant or animal, dead or alive, may be made into manure; all that is required being, that it shall first undergo putrefaction or decay, so that its elements may become soluble again in rain water. Long continued exposure to the air will cause the gradual decay of the hardest substances of vegetable or animal origin: Sawdust, bark, nutshells, peat, wool, hair, horn, bones, ivory, teeth; these will all decay in the long run; but, the mode of ensuring their rapid decay is to mix them up with other matters more susceptible of active decomposition. *In this way all organic matters are innoculated with the principle of decay, and become manure.*

But, are all the elements of the manure of equal importance? Are there not many of them already in the land? If so, why carry them on the land? Can we not find the most needful

elements in some more concentrated form at a moderate price, so as to save in the item of carriage at all events? Such very natural questions have all been put; and exact, and satisfactory answers have been given to them. All this is progress: we now know the name and nature of most substances available for manure, and we know how most economically to make, compound and apply them.

In former times, barn yard manure was almost the only known kind of manure; and truly it ought to be, and truly it always will remain the most valuable ally of the farmer. But its supply is always regulated by the number of cattle which the farm can support, or the cost of its carriage from other places.

When I state the fact that cow-dung contains 90 per cent. of water, you will understand my train of argument; and it will be further strengthened by learning that, of the remainder, about one half would be supplied by nature without our interference at all. That is the reason why, ever since 1840, it pays to bring guano from the other side of the globe itself, to the fields of England. It pays to bring guano, or nitrate of soda, for fifteen thousand miles to England, simply *because* they contain in a more concentrated form, the most essential constituents of barn yard manure, an article which itself cannot be profitably carried ten or fifteen miles, and which, by improper treatment, may not be worth carriage for a quarter of that distance. One of the valuable elements of farm yard manure is ammonia, or "putrid Nitrogen," as it has been called. It is present in variable quantity, according to the way in which the manure has been managed: box manure contains about 20 lbs. to the ton; well washed manure does not contain more than 5 or 6 lbs.; but, on the average of good farms it may contain about one half per cent., or 11 lbs. to the ton. Now the money value of that ammonia at the maker's is about seven or eight shillings; so that at remote places, it may be much better economy to buy the one than the other. The same quantity of ammonia might be had in 50 or 60 lbs. of guano, of which the best kinds contain nearly twenty per cent. of ammonia. In 1855, there were imported into England about 240,000 tons of guano, containing from forty to fifty times more ammonia and phosphoric acid than barn yard manure, and therefore equivalent to about ten millions of tons of the latter; and as one ton of guano will grow eight tons of wheat, it was equivalent to the importation of nearly two millions of tons of that article. Nitrate of soda is brought from Chili for nearly the same purpose as guano, and its importation and use are found to be profitable.

Bones, which contain twelve times more of the Nitrogen or forcing principle, and eighty times more Phosphoric Acid or grain forming principle than stable dung, are imported from Rio Janeiro and Australia; and, when applied to worn out pastures in Cheshire,

under the form of Bone dust, or as "Superphosphate," are found to pay 25 per cent. on the operation. One hundred weight of Peruvian Guano yields (besides Nitrogen) Phosphoric Acid for about 18 bushels of wheat, and 1800 pounds of straw.* More than 30,000 tons of Bones are imported annually into Great Britain for manure. Thus it will be seen that our list of manures has increased most materially, and that we know how to estimate the money value of all natural or artificial compounds offered as such.

By such new fashioned articles as manures, the farmer is enabled to render his land more productive, to renovate quickly land which has been exhausted by cropping, to bring land rapidly to its highest pitch of fertility; to maintain whatever rotation or succession of crops as is most profitable in the particular locality; to invigorate weakly crops, and to supply himself with any amount of general or special manure at the shortest notice.

"In the case of Guano, and the Salts of Ammonia," to use an expression of Mr. Lawes, "pounds weight only of manure are "brought upon the farm to produce tons of growth; in the other "you bring tons to produce pounds."†

You can now understand how guano and the superphosphate of lime—things undreamt of by our forefarthers—saved English farmers, at the time of the repeal of the Corn Laws, by giving such an increased productiveness to the land as to make up for the sudden fall in the price of food.

The demand for these new manures in England generally exceeds the supply, and, at the present time the Royal Agricultural Society of England offers a prize of one thousand guineas to any one who will suggest a prescription for a manure that shall contain as much nitrogen as guano, and be available for general use at prices not exceeding £5 per ton. There is no trouble in making a mixture equivalent, in manurial value to guano, or more than equivalent; but, at present, we do not know how to do it at the price paid for the genuine article;‡ for the ammonia in guano comes cheaper to the farmer in that than any other form: The price of ammonia in fact may be said to regulate that of guano. If Chemistry could shew us any way of cheapening ammonia the price of wheat would fall, and the Chemist would have more to do with fixing the price of beef than the butcher himself. Notwithstanding the large amount annually disbursed for new manures, agriculture in England was never so productive as at the present time and so profitable to both landlord and tenants. Since the beginning of the present century rents have doubled; the breadth of land under crop has vastly increased; the productiveness of the land has increased nearly one half; food has become cheaper and the

* Journ. R. Ag. Soc. xii. 37. † Journ. Soc. Art, iii. 264.
‡ Scottish Journ. of Agriculture for 1852, p. 199.

farmers or producers of food much more wealthy, intelligent and contented.

3. *Rotation and Green Crops.*

There are few departments of husbandry in which greater improvements have been made than in the order of crops successively sown in any one field. The practice has improved, and the principle of the practice is well understood.

In early times when a field ceased to be productive it was left *to rest* because it seemed *tired* of bearing crops. At a later period, it was discovered that productiveness would return by repeated ploughings and harrowing of worn out land, without manure or any external addition; this kind of treatment was called a *bare fallow*, and, of course, it operated more quickly if manure was added at the time of fallow: but, in either case, no crop could be got for the season, and it added nothing to the manure heap or the pocket. The next improvement was the introduction of green crops, such as turnips or clover alternately with the grain crops: these, while they involved a good deal of stirring of the soil, exhausted it very sparingly, inasmuch as they derived most of their nourishment from the atmosphere rather than the soil.

But this alternation of green crops with the white or grain crops was a great innovation, and it took a long time before farmers would give up the fallow for the fallow crop, or put any faith in the new doctrine of a rotation of crops being necessary at all.

The object of the fallow crop is to make the effect of manure go farther, and economize certain constituents of the soil, which are all removed, though in unequal proportions, by the different groups of crops, known respectively as grains, roots and forage grasses. About one hundred years ago, the ordinary Scotch rotation was, wheat, barley, peas, oats, and then pasture for an indefinite period. In Ireland, two crops of potatoes were first taken, and then oats until there was a return of no more than three seeds for one. Even in Wales, at the present day, it is covenanted in some leases, that *not more* than four white crops shall be taken successively from the same field.

In New Brunswick according to the testimony of my friend, the Hon. James Brown,* "many farmers take one crop of grain after another, year after year, from the same ground, until the soil is completely worn out, or, they mow the same field annually, sometimes for more than twenty years, or until the hay will not pay for the cutting. There are exceptions to this exhausting system, but it is extensively practised throughout the Province."

The belief in the necessity of a rotation, or series of crops between any two of the same kind, is now a fundamental article in the

* Johnston's Report, p. 170.

agricultural creed. When this notion was first propounded, however, it was duly sneered at by *the mere practical man*. In that day, turnips, mangolds, potatoes, carrots, and clover, would be viewed with great suspicion as field crops; but they are all now thoroughly established as such, and it is to be regretted that their culture is so much in arrears with us here, long after their importance in a rotation, and their high place as food for stock have been fully admitted in England and elsewhere. Our climate, it is true, is somewhat different from that of England: we cannot feed turnips off the ground here as they do there; but, even there, house-feeding with roots is regarded more favourably. Turnips keep perfectly in a well ventilated root-house, and when cut or crushed are highly relished by cattle, either by themselves or with half hay or half chopped straw, or pease meal, or oil cake, according to circumstances: turnip tops afford much food for beef cattle, and carrot tops for milch cattle. We would prefer carrots on the light, rich intervales; turnips or swedes, on light upland near the coast, and mangolds on the same soils in the interior.

The climate of the west coast of Great Britain and Ireland is much more damp than our own; but that of the east is dry, and so is that of the interior of France and Germany, where root crops succeed admirably. The mean temperature of the year, in Great Britain, is between 45° and 50° F.; that of New Brunswick is about 41° or 42°. This seems at first a great disadvantage; but the growth of crops is chiefly regulated by the mean temperature of the months of June, July, and August. Now the mean summer temperature of these months for Great Britain, is about 60°; for New Brunswick, it is about 63°. Our summer therefore is hotter, and it actually lasts for nearly half a year; rain does not materially shorten this working period of the agricultural year, as in England and Scotland; and the winter's frost here serves partly instead of the numerous furrows, rollings and harrowings required to prepare the soil for the seed, in the old country.

The introduction of root crops and clover in England was a capital improvement, and effected a complete revolution in farming economy; the yield of food by this system of *alternate husbandry* was so great that more stock could be wintered and fattened: one acre of turnips was found to be equal to three acres of meadow; more manure was made in proportion, and consequently, more grain crops could be raised than before. One acre of corn or potatoes will of course yield more food *for man* than one acre of Swedish turnips, mangolds or carrots; but, while the latter require a little more labor, they are less severe upon the land, and are nearly all returned as manure, and cattle fed upon them are sold off the farm to the butcher. While admitting the strong temptations to grow potatoes at present prices, the greater familiarity which

most farmers here have with the culture of potatoes, and, particularly, the difficulty about cheap labor, we must still urge the essential importance of the turnip crop as a supplement to the hay crop, as winter food for cattle, and as a more ample source of manure, so as to give us more abundant grain crops, a shorter rotation and greater productiveness. *There is no other crop which will give the same weight of food per acre as the roots above referred to, and there is no other crop which allows us to maintain the fertility of the soil so economically.* We may get from one and a half to three tons of hay per acre, but, we look for ten, twelve, thirty or forty tons of roots.

If the supply of labor required for turnip culture can be had in country places here, we venture to press it again upon the attention of all concerned. The horse drill, and drill harrow will save much of the labor; sowing in damp weather will often protect the seed from failure, and guano or superphosphate, with thick seeding, will almost always secure a turnip or carrot crop against the fly and climate; with twenty or thirty loads of short manure per acre any light deep soil will suffice to grow these roots, and thus yield that increased supply of *manure, without which the improvement of agriculture is literally impossible here with us.*

The system now followed in England, on a farm of one hundred acres of light, arable land is, 1st year, roots; 2nd, wheat; 3rd, clover; 4th, barley. That is the well known Norfolk, or four-year, or four-field course. By the old fashioned rotation, a similar farm would have yielded annually 1600 bushels of grain, and 42 tons of straw: by the new one, the yield would be 3200 bushels of grain, 42 tons of straw, 35 tons of hay, and 500 tons of turnips. In other words we save the bare fallow, and obtain twice as much grain, and twelve times more material for manure.*

In the poorer soils of Northumberland a five-shift course, which is less severe upon the land, is followed; it runs thus: 1, oats; 2, turnips; 3, wheat or barley; 4, clover and grass; 5, clover and grass. The rotation of the Lothians extends over six years, thus, 1, grass; 2, oats; 3, potatoes and beans; 4, wheat; 5, turnips; 6, barley.

A six-field course, formerly suggested† as suitable for this country, in breaking up old pasture lands for average soils and seasons, consisted of three sixths of grass, two sixths of grain, and one sixth between roots, cabbage, or corn, thus: 1, oats or peas from fall ploughed sod; 2, roots, with, say, 15 to 30 tons of manure; 3, oats or wheat; 4, hay; 5, hay, top dressed, and with the after-math not fed off; 6, pasture or hay. By feeding the crops on the farm, and by the use of a small allowance of guano or Superphosphate with the root crops, and with lime, plaster, ashes and compost on the second

* M'Culloch's Account of British Empire, I. 588. † Rep. N. B. Soc. I, 26.

or third hay crop, the fertility of the land would be fully sustained, and the returns in grain, beef, pork and dairy produce very satisfactory.

If we were to admit the idea of degrees of fertility, by which the condition of the soil should be stated or measured, the account of the soil, at the end of this rotation would stand approximately thus:—

	Cr.	Dr.
1. Grain, from the sod, - - -	10°	50°
2. Roots, - - - - -	10	25
Manure, - - - - -	100	"
3. Grain, - - - - -	"	50
4. Hay, - - - - -	"	25
5. Hay, top dressed, - - -	50	25
6. Pasture, - - - - -	10	"
	180°	175°

Cr.—Gain of fertility in six years—5°.

It is calculated that simply to sustain the fertility of an average soil, manure should be applied at the rate of five tons per acre for every year of the rotation, unless the rotation includes some years of pasturing which, of course, rather inprove than deteriorate the soil.

The golden rule of not taking two grain crops in succession, has lately been somewhat controverted; but the doctrine must always remain true, so long as the object of rotation is understood to be *the economy* of manure, or of the mineral elements of the soil.

If the farmer be energetic, the market convenient, and manure and labour cheap, any succession of crops may be grown without risk of exhausting the land; that is, on land that is clean, dry, and rich, crops may be grown in any succession proper for the climate; for the climate chiefly regulates the classes of crops, and the soil their succession. This kind of *free cropping* just alluded to, is always followed by the London market-gardeners, who pay no regard to any special rotation, but merely plant the crop which is next required in the market, on such plot of land as happens to be ready for digging up; though, of course, they manure heavily for every such crop.

Mr. Lawes of Rothamstead, a farmer and not a gardener, has now grown wheat upon the same land for eleven years in succession. Of his fields, one has had 14 tons of dung every year, the adjoining one has only had superphosphate of lime and salts of ammonia in equivalent quantity. In ten years, the increase of corn was from 22 to 41 bushels per acre, from the dung, and from 1476 to 4543 pounds of straw per acre, on the other lot the increase has been from 21¼ to 50 bushels of grain, and from 1480 to 6634

pounds of straw. The *artificials* have therefore more than replaced the so called natural manures;* and the experiment is important as showing that manures containing carbon, in other words, barn yard manure, may be dispensed with altogether, in certain soils and for certain crops, at all events.

4. *Stock Husbandry.*

Farming, or at all events, the mixed system of husbandry followed in New Brunswick, involves both the raising of crops from the land, as well as stock from the crops; and there is an intimate connection between the two operations.

There is some obscurity as to the origin of our domestic animals, just as there is in regard to that of our cultivated crops. The breeds known to our forefathers, however, were probably improvements upon the wild stock, as their *derivatives* generally are far superior to those which were known to our ancestors.

The laws of nature which affected the breeding of animals were little known at first, and the power of fixing special points of form or constitution was undiscovered. It is exactly one hundred years since Mr. Bakewell, of Dishley in Leicestershire, began his experiments upon sheep: he was soon followed by other stock farmers; and, as the result of their joint labours, we can now boast of many distinct breeds of the several domestic animals, each of which has fine symetry, as well as some other special excellence of its own, fitting it for some peculiar purpose. Thus, the Leicester breed of horses is best for heavy drays; the Cleaveland for coaches; the Clydesdale and Suffolk for farm carts; and, for the saddle, we have hackneys, hunters, and racers. Among cattle, we have the English Durhams, Devons, and Herefords, the Scottish Ayrshires, Galloways, and Highlanders; one or other of which is specially remarkable for meat, milk, or labour. Among sheep, we have some breeds remarkable for their fleece, and others for their flesh and fat: we have long wooled Leicesters, short wooled Southdowns, and so forth. Among pigs, the coarse, dull brutes, with long bodies, legs, ears, and noses, intermediate between a crocodile and a jackass, have given way to the sprightly Berkshires and the shapely Suffolks, with short bodies, legs, ears and heads, but always fat, and soon coming to maturity; a maturity characterized by flesh and fat, where the old breeds were much more remarkable for bone. Among fowls, we have Polanders, Spaniards, Dorkings, Shanghaes, and all the rest of them, each good of its kind, and more nearly resembling turkeys in size than "good old fashioned hens."

The high character of the English horse is now thoroughly established; the same is true of all other high-bred stock, and it is a matter of fact as regards them, that they come earlier to maturity, while their net weight is more than twice as great as it was at the

* Journ. Soc. Arts, III. 263.

beginning of last century. The treatment of diseases in stock is not now in the hands of empirics but of men skilled in the principles of their Art. Veterinary medicine is now a science.

But, it is often asked why we should send for English horses or cattle here; why not make up the country stock, many of which especially the milch cows, as we all know, are very good, and even give more milk than *some* of Mr. Gray's thorough-bred Ayrshires. This may be all true, but still the art of making up a breed is a most difficult one to learn, and, the breeds *are already made up in* England and elsewhere; and, whereas our native stock may be good *as individuals*, there is no security as to their progeny. The pure breeds are, as near as possible, certain and true to their kind, that is *the progeny will have as nearly as possible the special qualities of the parent stock;* and that is the reason why thoroughbreds are always to be preferred to common breeds or mongrels. I am desirous that this point should be properly understood, seeing that, in my belief, New Brunswick farmers ought to be more interested in stock husbandry than they seem to be.

Those who have seen the stock imported into this Province of late years, can well understand the importance of this subject; the only question is, how to get the whole of the old stock most rapidly replaced by the new ones. The Societies ought to attend to this subject particularly, and it might even be desirable to have a sort of model farm for testing improvements, and raising improved stock and seeds, within the country, on public account, as is now proposed by the intelligent farmers of the neighbouring colony of Prince Edward Island.

We now understand, I hope, that there has been at least as much progress in stock husbandry, as in tillage husbandry; that is, if we are to judge by the power which we possess of securing a reliable result. Agriculture, in this respect, has attained to the rank of a scientific manufacture, and the sooner it is so, in *all* its departments, the better both for the farmer and the public.

To improve our native stock, we must have full bred males; from the improved stock fed upon a more liberal supply of roots, swedes, turnips and carrots, during winter, we may get that kind of beef which alone is fitted for curing, and that increased supply of manure which is now imperatively required to bring back fertility to a great proportion of all the cleared land in New Brunswick. "We ought not to imagine," says Columella, "that the earth, which the Great Architect of Nature has gifted with a perpetual fecundity, is liable to the disease of barrenness, after having received from its master an immortal youth, which has obtained for it the title of the *common mother of all things*. It is neither to the foulness of the atmosphere, nor to age, that the sterility of our land is to be imputed, but to our own mismanagement and neglect."

III. *Of the progress of the Science of Agriculture.*

In the early stages of the history of our subject, there would be few speculations concerning the occult causes of fertility. The labour of one man, applied to the culture of the soil, would, at first, produce much more than was necessary for his own support, and for that of his family, so that a surplus stock of food would remain on hand, from which others might be fed, while they applied themselves to pursuits of another character than the production of food and clothing. So long as labour applied upon the land produced this surplus, civilization and improvement would proceed; but, when the land ceased to yield to labour the required surplus fund of food, the frame-work of society would be dissolved unless means were devised whereby the farmers' labour should again be rendered as productive as it had been when originally applied upon a virgin soil.*

The first and simplest remedy, in the case supposed, would be the search for a new soil, where agricultural labour should again produce the surplus required. Such is the simplest statement of the case, and the one generally assumed as the starting point by political economists; but at the present day, the argument must be modified to a certain extent, for the surplus of one country or nation may now be freely and cheaply conveyed to the people of another where agriculture does no more than sustain those engaged in it, while the labour of the others is applied to procure or give exchange value to objects that may be exported, and used to purchase food for importation. If such supply of furs, or gold dust, or fish or lumber be abundant and unfailing, and if the demand for such staples be equally certain, agriculture may be left to take care of itself; but again, if there be any uncertainty in the supply or demand of the staple supposed, then must there be ruin and desertion awaiting the country which cannot maintain, by the productiveness of its soil, a cheap supply of food and clothing for its inhabitants.

In the early periods of the history of a country the *theory of fertility* would be uncared for, but, ere long, it would be found that the soil which at first yielded a surplus of food would cease to do so. Let us suppose that lumber, the staple of any given country, is in demand; the farmer immediately becomes a lumberman for the time, and gets enough wherewithal to buy the necessaries of life, or more; but the demand for lumber is uncertain, while the deterioration of a farm by neglect is by no means so, and, ere long, our friend, who had overlooked first principles, is in danger of starving. But, supposing there were no other resources than the soil, then the first remedy in the case of an unproductive field or

* Alison on Population.

farm would be the enclosing or bringing in of another, provided that another could be had at a fair charge, and that it had all the fruitfulness of the first field which was occupied. This practice is much followed here, where land is still cheap, because the population is comparatively scanty. By-and-bye it would be found that much of the deserted land had regained fertility, by having merely remained out of culture for a term of years. This is the *rest* formerly mentioned; and with us, it is generally a very long and weedy rest indeed.

The next device in point of time, for bringing back fertility, was the *naked fallow*, a laborious operation, and involving also the loss of one year's production. Next came *manure* with *fallow cropping*, *rotation*, *drainage*, and *irrigation*. *Home-made* manures would be tried first, next, *extraneous* manures, such as lime, ashes, bones, guano, mineral manures, and lastly, as the climax of all, *manufactured* manures applied in the liquid form, and with the probability that instead of *special* manures, there may be ere long expected a portable manure, suitable for all soils and all crops, a *panacea* for sterility, an *elixir vitæ* to sustain the youth and fruitfulness of mother earth for ever.

Certain practical farmers, even in very early times, it may be supposed, would find out means of sustaining the fruitfulness of their farms. The Art would progress while the theory or principle of the art would be unthought of; but on that very account, the art would be uncertain and unsatisfactory; plans which succeeded here would fail there, and slight differences of soil or climate would nullify all the practical rules, so called, of experience. The cropping of light and heavy soils for instance is very distinct, and crops must vary with the season and the market. Hence the knowledge of one man would be of little use to others, because it would only be available under circumstances exactly similar to his own. There could exist no knowledge of *natural laws* but only a tradition of successful practices. "The true practical man," says Baron Liebig, "deduces, in agreement with the theory which he knows, and which sharpens his powers of observation and guides his intellect, *the most profitable method for every different case as it occurs*, and he renders the most unfavourable circumstances more propitious to his objects in the shortest time and at the lowest cost."*

It is imperatively necessary, therefore, that the farmer should understand what is meant by the phrase *fertility*; if he does not understand this, he cannot be supposed to be able to economize that property in his soil, or to restore it when it has been altogether destroyed.

The explanation has been given by chemistry, a science which is of much younger date than agriculture; and if chemical theories

* Liebig's Prin. Ag. Science, p. 15.

have not always proved profitable in the practice of agriculture, the farmer has himself to blame for not properly understanding the tool which he was handling, and the way of applying it in the case.

The fertility of land rests upon two distinct bases; the first is its natural capacity for cropping, depending upon original composition, texture and depth; the second is derived from artificial treatment, which must affect its chemical composition, as well as its mechanical qualities of texture and available depth. These two causes may, and ought to concur if it be possible, in every case.

One of the first attempts to solve the farmer's mystery as to the cause of fertility, was made by a Dutch chemist called Van Helmont, who wrote in 1610; his argument might be stated thus:—

Plants growing in water, increase in bulk or mass;
Water is present in all soils where plants grow;
Therefore—Plants are wholly formed from water.

But Van Helmont in his experiments had used water, which, as Woodward shewed, had contained other ingredients. No crop will ripen in pure water, and Van Helmont's *water-theory* is now forgotten.

About one hundred and twenty years ago an Oxfordshire lawyer and farmer, Jethro Tull, started a new doctrine, which may be stated thus:—

Crops grow in a soil which is thoroughly stirred and pulverized;
They refuse to grow in one which is not so tilled;
Therefore—"Every plant is earth, and the growth and increase of a plant is more earth."

But it may be shown that no soil however fine, can of itself enter the roots of a plant, so that soil *alone* can not be the sustenance of plants.

Tull, however, held on to his *mineral-theory* bravely. He was the originator of deep ploughing, of the horse hoe and drill; which latter implements, it is said, have saved his country, in seed alone, the food of millions. At length Tull's crops began to fail, notwithstanding his laborious tillage. Something was wrong, apparently, but he could not find out what it was. In truth, his doctrine was unsound, and his practice imperfect; he continued to plough and pulverize the soil and *eschewed manure;* so that he starved his crops and beggared himself.

A Swedish chemist of the name of Waller,* about a century ago, proposed a new and what he considered a true account of the nutrition of crops. His argument may be stated thus:—

Plants consist chiefly of such substances as exist in the air;
They contain a very minute quantity of mineral elements;

* Kemp's Phasis of Matter, ii. 248.

Therefore, air is the true food of plants; minerals are unsuitable as food, and the soil only serves to fix and steady them in their place.

But lime, chalk and marl were well known even at that time as fertilizers, and Waller's *air-theory* could not give any account of their action:—there was a screw loose somewhere.

Each of the arguments above mentioned contained a partial truth, and it can now be shewn that earth, air and water are, *collectively*, the food of plants, and that *fertilizing* a soil means supplying it with food, that is, with the chemical elements of the crops to be grown upon it.

This principle could not be fully established, however, until Chemists had thoroughly ascertained the composition of plants, soils, air, water and manures. This is now known, and the discussion at the present time, is chiefly as to *the form* under which the elements enter the plant, the *sources* from which they are individually derived, the *avenues* by which they gain admission, their *relative importance* as constituents of manure, and the *mode* in which they are transformed into woody fibre, starch, gluten, sugar, oil, and the other parts of the fabric of plants.

The present state of our knowledge in regard to scientific agriculture is the result in great part of the labors of Davy, Grissenthwaite, Liebig, Boussingault, Mulder, Way, Lawes, Gilbert and others.

In each seed of our crops there lies enshrined a *germ*, which consists of a rudimentary root, stem and leaves. When the active life of this little germ commences, which it does soon after the seed is sown, it feeds at first upon the concentrated food laid up in the cell-chambers of the seed,—like a mouse in a cheese, or rather, as young bees in the cells of the comb, live upon bee-bread or honey, or as the chick is nourished and formed from the liquids in the egg. By the time that the contents of each little cell in the seed have been consumed, the young root and stem of the germ have grown too large for their envelopes; they emerge accordingly, and straightway begin to drink in, from the soil and the air, those supplies of food, which, in the quiet cells of the new plant, as in the laboratory of a Chemist, are further fashioned into its own growing mass and fabric. The presiding power is called the *vital principle*, the *stimulants* of the vital principle are heat and light, and the *action* of the vital principle is exerted—a daily miracle—in transmuting earth, air and water into the tissues of plants and animals, their parts and products; for, as has been said by Liebig, the animal organism is but a higher kind of plant.

The food of a plant is certainly some *thing* that passes into it from without, and diminishes by so much the original supply of that *thing* in the soil or air where the plant was growing. But

analysis shows that the thing, which is thus abstracted from the air or soil, is a mixture of twelve or fourteen different substances, some of which may have entered by the leaves, but most of them, dissolved in water, by the roots of the growing plant.

Plants therefore are, all day long, pumping water upwards by their roots to their leaves, and this water holds dissolved in it something from the air and something from the soil; most of the water is evaporated by the leafy surface, (a cabbage, for instance, will evaporate more than a pint a day), while some remains behind as *sap*, holding the other matters in concentrated solution; the living force of each of the many millions of cells composing the plant is now exerted upon this sap, and thereof the bulk of the crop is built up. A full crop of wheat, in this way, removes annually from the soil many tons of water, and some hundred weight of mineral substances; nevertheless, the supply of some of these elements remains inexhaustible, while that of others is much more limited, and requires frequent renewal.

The bulky portion of a plant, or that which disappears in burning, consists of Carbon, Nitrogen, Hydrogen, and Oxygen; the first is a solid, the others gases; and all are capable of becoming soluble in water and dissipated by fire. They constitute the *atmospheric food* of plants, being derived from the air under the form of carbonic acid, ammonia, and water, and amount to about 95 per cent. of the whole mass.

The ashes or *earthy* elements of a crop from one acre of land are given in the table subjoined. I give also the analysis of hard wood ashes, in order to show how the fertility of burnt land is to be explained, as well as the use of ashes as a manure:—

Mineral Elements.	Wheat.	Oats.	Turnips.	Beech wood.
	lbs.	lbs.	lbs.	Per cent.
Potash,	25.70	42.26	201.68	15.83
Soda,	1.87	17.91	39.21	9.79
Magnesia,	7.18	10.66	21.54	11.29
Lime,	10.19	15.99	107.68	63.37
Phosphoric Acid,	19.65	14.90	62.00	3.07
Sulphuric Acid,	5.90	6.29	78.82	1.31
Silica,	102.65	100.61	14.24	1.32
Oxyd of Iron,	1.51	9.27	6.29	.79
Common Salt,	.35	.11	68.54	.23
Totals,	175.00	228.00	600,00	100.00

A virgin soil, we have said, is fertile by nature, and an old soil, sterile from cropping, may be rendered fertile again by manure. If sterility depended upon any material things, these things have re-appeared in the manure; the manure therefore substantially

represents the principles which were present in the virgin soil; they were taken away from that soil by the crop, they fed and nourished that crop and enabled the germs in the seed of that crop to fabricate cell after cell, and so to grow to maturity. Fertilizers, therefore, are the necessary food of the crop, and fertility implies the ability to supply it of the kind and quantity required: this, of course, must be the same as that which was removed from the soil or atmosphere by the crops previously taken from the ground, and which is now represented by the substance, or by the *excreta* of the men and animals which were fed upon these crops.

According to the above theory of fertility, *rest* allows the weather—meaning air and water—to prepare a fresh supply of mineral food from the coarser particles of the crumbled rocks which constitute the soil; it also allows of an accumulation therein of the decayed remains of native plants and animals; a *bare fallow* acts chiefly in the same way, but more quickly; *ploughing in of green crops* is still more rapid in its action; and *fallow crops*, as involving manure, deep tillage and so forth, (while not drawing heavily on the soil for supplies), are much the same. *Barn-yard manure* represents the crops themselves; *irrigation* returns the elements of the crops along with much water; and *artificials* are imitations in a pure and concentrated form of the same things.

No future discoveries can overthrow the general theory of fertility as now understood, although the details of it may be much farther elucidated. The above is an expression of what is called a Law of Nature, which means, the ordained will of God.

Nor can future discoveries in science affect the well established rules of practice as regards draining, clearing and stirring the land by tillage; all of which directly contribute to fertility: thus, if a soil be so open as to part with its moisture too readily, or to allow the gases from the manure to fly off into the atmosphere; or if it be so close as to prevent the free circulation of heat, air and moisture; or, if it be stiff, stony or lumpy; that soil will not be so fruitful as it otherwise might be: these mechanical conditions are required towards rendering the supply of the chemical elements available as food; one portion, for instance, must be in the finest possible powder before it can even be dissolved in rain water, and another portion must be coarser, so as to permit a free movement of air and water to and through the former.

But, it may now be inquired whether all of the elements of a plant as shown by a chemical analysis are equally important. Undoubtedly they are so; the *principle of life* can only dwell in a mansion made up of many, and some of them, rare materials; for so the Father of life ordained, when he created plants to purify the atmosphere, as they do, to sustain the life of animals, and to delight the sense and the spirit of man.

In the complex mechanism of life the small pinions are as important as the large wheels, but, as far as agriculture is concerned, it appears that the supply of the great bulk of the food of crops is effected by nature from any average soil or from the atmosphere, provided, that man will attend to the small remainder.

In the case of New Brunswick, as in many other cases, the virgin soils were certainly very fertile, but that fertility greatly depended upon manurial elements directly or indirectly accumulated by the operation of burning up the trees; these were soon removed by the crop or by the weather, and it is a mild form of insanity to suppose that because the land was fertile after one such good manuring, it will always retain its original qualities, notwithstanding that its available food-elements have been taken away, as oats, hayseed, or potatoes. You may break the Bank of England, if you continue drawing money from it without making deposits in return; and in making deposits there, it may be more convenient to carry them in the form of gold than of copper. Crops are as checques drawn upon the land; manures are the deposits; guano and bone-dust are as gold and silver, while farm-yard manure is the bulkier but not more valuable copper.

Farm-yard manure has been termed, and truly is a *universal* manure, inasmuch as it is capable of supplying all the elements of crops, while every other is more or less *special*, and yields only a few of them; but science, in combination with practice, has discovered the *manurial value* and the commercial value of all fertilizers, and of each of the elements of the food of plants. It has shown clearly likewise that if you place from time to time in the land only a few of the total number of food-elements required, you may leave the care of the remainder to nature. The soil is the true "Farmer's Bank." If you deposit a pound of plant-food there, you may draw a ton of crop in return, and you may do this either in one year or in several, as you think proper. The Divine Law declares that if man does a little for himself his Maker will do more; but only upon the condition of co-operation; and this is more specifically true in farm work than is commonly understood.

No facts or arguments can lessen the importance of barn-yard manure, which, if well made, will always yield to land the food of crops, *at the lowest possible price;* but, if only a little of it can be had, or if the cost of transport be greater than its intrinsic value, surely it is a great point to know, whether or not in seeking for substitutes or imitations of manure, we need to procure a *complete* copy of that old and well known fertilizer, if that were possible.

If a traveller should have occasion, when in China, to get a new coat, and should send his old one as a pattern, it is said, that the Chinese tailors will sometimes send back a new and laborious, but perfect imitation of the old one; this is simply ridiculous, but the imitation of manure in that way, even if it were possible, would

be much more preposterous. Eight or nine tenths of ordinary manure is (mere water), of no value whatever, and the operation of conveying it all to land is worse than carrying coals to Newcastle; it can hardly pay to carry it very far at any rate.

The elements of fertility or manure, according to high authority,* rank, in commercial value, in the following order:—

1. Nitrogen,
2. Phosphorus,
3. Potash and Soda,
4. Lime and Magnesia,
5. Soluble Silica,
6. Humus-forming substances.
7. Sulphuric Acid,
8. Chlorine, &c.

"Humus" is the name given to a dark coloured *charcoaly* substance of uncertain composition, always formed by the decay of manure, and soluble in water. According to some Chemists, the carbon or charcoal of plants enters the roots of a growing plant as *humus;* but, about a ton of carbon per acre is removed with a hay crop and did not exist and could not exist in the soil; accordingly this carbon must have been *in part* derived from the carbonic acid of the atmosphere. The carbon or charcoal which constitutes so great a portion of all plants, does at all events, enter them either as "humic acid" from the manure, or as carbonic acid from the atmosphere or the manure; and it is probable that this carbonic acid in combination with rain water and ammonia, serves as the proper solvent or vehicle for the phosphates and other mineral food, which would not be soluble in water alone; and thus, the supply of certain food-elements for crops may depend not so much upon the quantity of them which is present in the soil, as upon the proportion of some other elements which are required to release them from combination, or to render them soluble in rain water, which is the preliminary to their entrance by the roots in every case. The atmospheric constituents of the food must co-operate with the mineral elements, and—*vice versa*. Mr. Lawes' observations formerly referred to, (p. 46) seem to show that if the super-phosphate of lime and salts of ammonia alone are supplied to land sown *to wheat*, the growing crop will find for itself most of its carbon in the atmosphere; that is to say, the farmer might dispense with farm-yard manure altogether, which, but for its carbon, could be replaced by artificial mixtures in every case. This is the direction in which theory at present seems to point; but practice, as regards crops other than wheat, at all events, has not yet sanctioned such a wide departure from the good old path. If it should ever be shown that the carbon of all our crops was derivable from the atmosphere, farm-yard manures might be neglected as much as they are at present in New Brunswick—or with more impunity,—inasmuch as we could *readily* procure their equivalents in the shape of small parcels of clean and

* Prof. Volcker in Morton's Cyc. of Agric.

white chrystallized salts from the Druggist, as some enthusiasts recommend :—but no chemistry will ever make the farmer wholly forsake his old friend, so long as his old friend does not forsake him. There *is* reason then to think that plants may positively find for themselves Oxygen, Hydrogen and Carbon, the three bulkiest of the bulky, combustible portions of a crop of wheat, provided that the farmer supplies Nitrogen, the fourth, together with one or two of the mineral constituents of the ash; and more particularly Phosphorus. *Nitrogen* and *Phosphorus*, are sold to farmers under the forms of ammonia and Superphosphate, or guano and bone dust. I have said that there is reason to *think* so, but there is also reason to *know* that if you supply carbon as humus to the young seedlings the result will be more certain; and so for several other elements; at all events, it is better practice to offer too much than too little of all the elements of the atmospheric and mineral food required by growing crops, and if any of these are to be in excess let it be the Nitrogen, Phosphorus and Carbon. If the above mentioned *indispensable elements of fertility in every man's fields* be present, any crops may be grown in any succession; but it is certain that you may as well think to satisfy a hungry guest at a Barmecide's feast, as try to grow crops, when Nitrogen, Phosphorus, Lime and Potash are absent from the soil. The last two may possibly aid the soil to absorb ammonia and the nitrates from the storehouse of the atmosphere. Common clay soils, by virtue of the silicates of alumina, which they naturally contain, certainly operate in that way also; while sandy soils can do little or nothing of the sort.

If a given element be present in any soil to the extent of only one ten thousandth part, yet even that represents more than 350 lbs. as existing in the soil of an acre down to the depth of one foot; now the dressing of Guano or Superphosphate is about 2 or 3 cwt. per acre, and so you may understand how little Nitrogen or Phosphorus is required to be added to the soil to get a crop of wheat in return.

I beg here to subjoin a Tabular statement of the comparative quanities of the chief elements contained in 1000 lbs. of Straw, Dung, Bones, Peruvian Guano and Oil Cake:—

Constituents.	Dry Straw.	Fresh Dung.	Bone Dust.	Guano.	Oil Cake.
Nitrogen,	4 lbs.	4 lbs.	50 lbs.	150 lbs	50 lbs.
Phosphoric Acid,	2	3	240	140	25
Lime,	3	4	330	100	6

We have now learned what are the principles of fertility, and that Nitrogen, Phosphorus, Carbon, Potash, and Lime are the most valuable constituents of all crops; Chemistry further teaches us

that each of these elements has a special destination or purpose in the plant considered as food for animals, and that the general doctrine of fertility as regards crops may be applied, with little variation of terms, to the feeding of stock.

Food yields the elements of the bodies of animals; and the most valuable elements of animal food are Nitrogen, Carbon, and Phosphorus. In fact the commercial value of the food of animals is chiefly determined by its proportion of Nitrogen, just as we find that the value of manure is dependent upon the same element.

In the feeding of stock, *oil cake* is to hay or turnips what guano is to ordinary manure; that is, it contains in the most concentrated, available form, all the elements required for fattening cattle; five or six pounds being actually equivalent in nutritive value to about one hundred pounds of turnips. *Oil cake both fertilizes land and fattens animals.*

Not only have the elements of the plant a general adaptation to the animal fabric as a whole, but the special elements of the one are required more particularly for special uses in the other. Those parts of the crop, for instance, which chiefly abound in Nitrogen, are specially used for building up the flesh: the Phosphates go to solidify the bony frame-work of the creature, while compounds of Hydrogen and Carbon are specially required for maintaining the heat of the animal and laying on its fat. Exercise wastes the Nitrogen because it uses the muscles; cold wastes the Carbon and Hydrogen, for the same reason that we consume more coals to keep ourselves warm in January than in July, or in Canada than in California. From these principles there may be, and are derived rules of great practical consequence in the feeding and housing of working, growing, fattening, or milking stock.

Man, who is omnivorous, is himself sustained by the crop directly, or by the animals which are fed upon the crop, or by both together. The elements termed Nitrogen, Carbon, and Phosphorus, are, therefore, of prime importance to man and animals as well as to plants, and their agricultural history strikingly illustrates the character of the well appointed machinery of nature, where a system of wheels and pinions, cranks and levers, all work harmoniously together for a common end. In the case before us the result is *life;* without the elements above named, in fact, neither plant life, nor animal life is possible: accordingly, they have been *providentially* placed in the atmosphere, or in the rocky frame-work of the globe itself at its first origin. By the iron tooth of time, by the mighty agencies of flood and fire, by glacier, avalanche and iceberg, the rocks have been crushed, pulverized and fitted to form a soil, provided that the man who wishes to grow crops upon it will only do his share of the work, and *till* it from time to time. Plants,

finding in this soil water combined with small quantities of carbonic acid, ammonia and a few saline substances, slowly collect, digest, modify and compound them, so that they may subsequently become available as food for animals—a task which the animals themselves could not have effected. Animals restore these substances in part by their daily excretions, and finally, after death and decay, they return again as carbonic acid, water, and ammonia to the quiet earth, or restless ocean, or the air from which they were originally taken, in order that they might be clothed with life, and even for a time enshrine a living soul. *Such is the law of the circulation of Matter*:—under the divine influences of heat and light it passes unceasingly from the state of earth, air, or water, to that of plant, from plant to animal, and so to man, who, having for a time dominion over every living thing that moveth upon the face of the earth, yet, being of the earth earthy, must return to the shapeless forms and elements from which he was taken, to become again the mere food of plants and animals, for an indefinite succession of generations.

See now, this gracious morning time, how in that fragrant meadow, myriads of blossoms gem-like adorn the green and grassy carpet of our earthly home! In number and in beauty, they almost rival those golden fires which erewhile seemed to glorify its azure canopy! These various blossoms, arrayed as they are in the double charm of perfume and of colour, and environed by a thousand waving spears of emerald,—these beauteous daughters of Phœbus and Terra—grow, and are being fashioned day after day, by Power unseen, constraining the black and shapeless soil wherein their food awaits them! See those little lambs so pleasantly disporting on the velvet of the sward, and, all unconscious of the laws of Chemistry, most curiously converting it into the flesh and wool which are destined to become the food and clothing of man! See those herds of lowing kine, as they proceed upon their milky way! See the bright faces of those children, as they blythely frolic on the lawn, and who ere long will be the masters of that broad and well-tilled farm, and of all those flocks and fields! There comes the placid mother, and there the Father stands—of grave and earnest mien—a man beloved at home, and in his country's councils clothed with honour! That man, who by his intelligence directs, and by his energy sustains the whole establishment, his cheerful wife, and rosy children, all these intelligent creatures—immortal souls dwelling in frames of wondrous art,—all these have been, *in a positive and material sense*, built up, sustained, and clothed by the produce of their own soil—that which is to remain an inheritance for their children's children, for ever. Surely, this Agriculture is an art which exceeds all others in interest and importance! surely, the work in this manufactory must be pleasant

and wholesome! As the husbandman goeth forth to his daily labour in the field,

> Flowers laugh before him as he treads,
> And fragrance round his footing spreads!

In the pleasant fields, where food is to be formed for man, we see not the pallid face and the weary step of the jaded artizan; nor do we hear the stupefying, dismal hum of great, drowsy wheels, as in the crowded manufactories of towns, where the spirit is crushed with monotonous labour, and the strength withers under the influence of an unwholesome atmosphere. No! here—in the warm bosom of the fruitful earth, a certain number of simple or elementary substances which we *collectively* designate under the terms of water, air, and soil, are, by the inherent power of living germs, insensibly transformed into structures of consummate grace, breathing fragrance, and laden with nutriment;—superlatively excellent combinations! and like all other works from the same Master hand, teeming with the proofs of inexhaustible wisdom, beneficence, and power!

Such are some of the deductions of science applied to agriculture; they are in part, expressive of the principles upon which the fruitfulness of the earth has been fixed and determined by the Almighty, and they are regarded as laws by all intelligent farmers—first principles which are considered necessary for profitable use in the culture of land. Laws are imposed upon nature by the Divine Lawgiver; they are interpreted and declared by the Philosopher as soon as he himself can read them; and it is the duty of all who are affected in their business by the operation of such natural laws to know them, and profitably to apply them.

To give an application or general reference from the whole subject to New Brunswick,—I begin by supposing that much of the unproductiveness of our cleared upland is due to the defective education, rather than to the want of energy or of *moderate* means among its owners; that they believe in a better husbandry than they practice; that they want to know more about it, and that they will practice it at once, if labor is available, and a market easy of access. To such persons, and I know there are some of them, I would submit my views in a few distinct propositions or suggestions, which I hope and believe will be favourably considered.

1. Try to study the whole scope of the mixed husbandry followed here as a business, an art, and a science; consider agriculture as an investment for capital and labor, an art demanding special skill and dexterity, and a science most complex, involving a knowledge of very many and distinct natural laws.

2. Study book farming and make yourselves familiar with the language in which the results of agricultural science are recorded.

That may be done without becoming either practical Chemists, Botanists, Meteorologists, or Geologists, but plain farmers and men of business. A book or a journal should form a part of all premiums awarded by the County Agricultural Societies. *The science required in the actual business of farming is by no means great, and the time required to fix the reasons for the best operations need not be long.*

3. Graft Farmers' Clubs, for the discussion of science and of practice, upon the agricultural societies now existing, or upon any other society you please. A scheme for the management of such Clubs will be found in the Reports of the N. B. Society.* Interest yourself in the statistics regarding agriculture proposed by the N. B. Society,† and incorporated with the new law concerning Agricultural Societies. *Legislation and schemes of progress are most safely based upon full and accurate statistical returns.*

4. Having mastered the principles of fertility, do as the engineer does with the principles of mechanics, or as all men do, or ought to do with the principles of morality and religion; that is to say, let them dominate and direct you in the daily detail and practice of your calling hereafter. Art or labor guided by no fixed principles may be respectable, but it is not particularly pleasant; when, however, it is guided by principles, it is an unfailing source of pleasure, self-respect, and dignity. The farmer who combines science with his art, or improves his practice by his theory, or tests and establishes theory by his practice, is a Philosopher; and the best results must follow both to philosophy and humanity.

"But, my friend!" Agricola mildly observes, "Fine talk does not fill a farmer's barn; and granting all that you advance about Philosophy and Phosphates, and so forth, what do you really mean me to do about my bit of land, which is pretty well run out, I know, and promises to run me out too? Let us have a few words about the points of practice, if you please!"

To this appeal I would reply, but with some reserve, not as to the doctrine, but as to its applicability in every condition of the brain or of the breeches pocket of my agricultural friends in New Brunswick: They can judge of these for themselves, better than another can do it for them.

5. If you have capital to work with, extend your operations, but if not, contract them. Work a little less of your arable land at first so that you may be able to stir it a little deeper, drain it a little better, and enrich it a little heavier with manures which have not "wasted their sweetness on the desert air," and are *known at the time of application to contain the essential elements of fertility.*‡

6. Do what nature, and science, and practice, together declare

*Vol. I, p. 161. †Vol. II, p. 125.

‡See Journ. of N. B. Soc.; Report on Manures I, 90.

to be necessary, for your own children, as well as for the soil, and the stock of the farm; that is to say, keep them always dry, warm, clean, and well supplied with food. If the farm cannot make manure sufficient for the crops at first, let the farmer try as soon as possible, extraneous manures, such as guano, or superphosphate, (crushed bones dissolved in acid,) 2 or 3 cwt. of each, or the same quantity of plaster, salt, or Chili saltpetre, or from 10 to 100 bushels of lime, per acre; they may all be used with half dung, or harrowed in alone. If you are afraid of them in the field, try them first in the garden or orchard. Plough up mossy, hide-bound pastures, and in spring top dress such grass lands as are to be mown with manure or compost, containing bog-earth, lime, plaster, salt, ashes, or some of the new mineral manures. The most important of the *waste* manures of the country are night soil, urine, wood ashes, leached or unleached, charcoal, bog-earth and marl. Diligently study the most effectual methods of weakening and wasting farm yard manure, then—*eschew them for ever and practice their opposites.*

7. Let oats be considered as the staple grain crop at present; but by better drainage, deeper tillage, and extraneous manures, strive to improve the *local soil and climate*, so as to establish Spring wheat, if it be possible, in their place.* The crops most to be recommended, as additions to those usually grown as field crops, are turnips (3 or 4 kinds), especially Swedes, carrots, parsnips, mangolds, hay-seed, and pease. These are to be sown, not in succession, but in rotation. One acre of potatoes will fatten one beast, an acre of turnips will fatten two, and these by house feeding will yield 20 or 30 tons of manure. These roots, by themselves will go twice as far for food as potatoes, and three times as far as hay for food or manure; *with oil cake, chopped hay, straw, meal and salt, the roots will go twice as far again.*

8. Buy more stock and of the improved breeds, but not before your land and barns will do justice to them; when you have got them, try to keep them dry, warm and clean, at all seasons; with these precautions, and with roots or pease meal, it will be found easy to fatten beasts of the kind; in fact it is always easier to feed beyond the average weight of grass fed cattle then to feed up to it. *Sheep and cattle feeding are the best occupations for winter.*

9. Ponder the subject of rotation and reflect that one manuring will do for four or five crops. Pay proper respect to Thistles, Bulls Eye, Couch Grass, Rushes, Moss, and the like; for they are as candid friends who rush into the sunlight to warn you to amend

* Since this Lecture was written, I have learnt through Mr Cuming, V. S, Saint John, that there is every prospect of spring wheat becoming established in the North of Scotland as a crop equally certain as oats, and of course much more remunerative. The example is encouraging to us, and the conditions there, as here, are a higher or more improving style of agriculture.

your style of husbandry: If you cannot succeed in keeping the field against weeds and water with all your efforts, my prescription is to *try California.*

10. Patronize ploughing-matches, and encourage the youngsters to plough deeper and straighter than ever their fathers did; in doing so, get them a better plough, and teach them to aim—not at a cloud overhead, but at a stake or other fixed object on the ground. Agricultural Societies should be obliged by law to hold annual ploughing-matches, for *without good ploughing there is little chance of good farming.*

11. Endeavour to see all the newly invented implements and machinery: they are intended to save farmers from toiling like farm-horses, to make them look like men, and to *work more with their brains and less with their muscles.*

12. In clearing hardwood land, sow oats and grass seed, which latter is worth fifteen shillings a bushel. Bee hives and grafted apple trees are better than sugar maples, and *they are about as easily cultivated.*

13. To *intelligence* as farmers, cattle dealers, and sheep dealers, join *economy* of time, money and materials, *energy* and perseverance in labor, both nervous and muscular, and *method*, above all things, in cropping, buying, selling, and keeping of farm accounts. Without business habits no pursuit can prosper, and, in the long run, assuredly, *good luck is always on the side of those who play best.*

14. I would beg to say that it seems to me to be desirable, and practicable as well as desirable, to begin the culture and discipline of the agricultural mind of the country, during the period of attendance of boys at the common schools, by the use of easy and attractive class-books and catechisms suitable for the case. What more interesting to the young, than the works of nature, properly understood! what more desirable than an early and intelligent love of nature! what more useful than the culture and discipline of the mind in the study of the laws of nature! Such knowledge is no weight to carry: it is always pleasant to meditate upon, *and profitable, when rightly applied by young farmers in the course of their business.*

15. Moreover, it seems to me that such knowledge might pervade the higher schools, academies and colleges; for all these are but *grades of schools* for the education of the youth of the country, in which they ought to be made acquainted with *things* as well as *words* and *figures.* Where agriculture is least advanced, there the introduction of its principles is most required; where nature is niggardly then is there most need of art; where nature is obdurate, there it is most important that we should not work in opposition to her laws; when the patient is very sick, then is there most need of a physician; where the patient is too poor to pay a physician,

or schoolmaster, let the State be required to provide them; where a knowledge of the principles of agricultural science and of improved practice is necessary for the proper development of the resources of the country, let this knowledge be given as a part of the public education provided for the young; for, where the *natural resources* of a country most require development, it is, in my opinion, the soundest policy *to begin with that of the mental capabilities* of the young, and more especially of those whose business is to be the culture of the soil, and a life-long, but friendly struggle with nature for *that suplus fund of food upon the existence of which the whole fabric of civilized society essentially depends.*